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# THE RHODESIA Agricultural Journal.

10.1.52.

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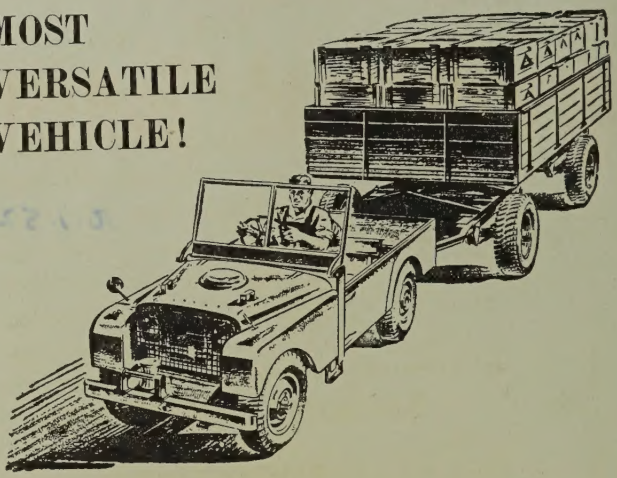

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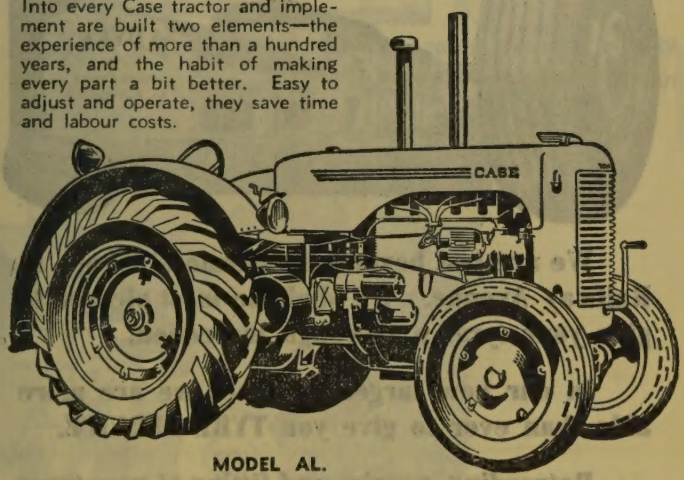


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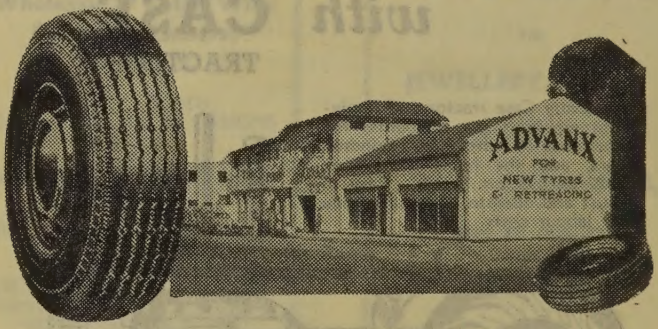


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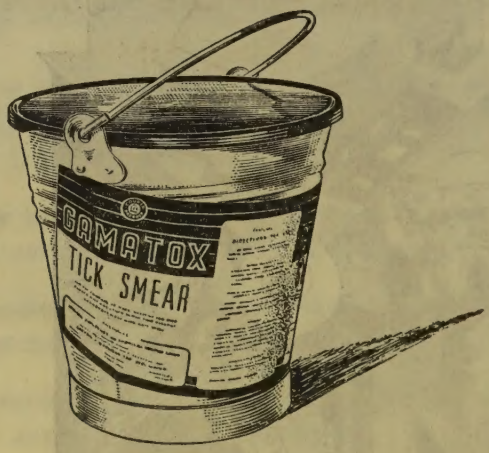


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THE RHODESIA

# Agricultural Journal

THE JOURNAL OF THE MINISTRY OF AGRICULTURE
Southern Rhodesia

Acting Editor : Marie H. Pardy, B.Sc.
(Assisted by the Staff of the Division of Agriculture and Lands).

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THE RHODESIA
# Agricultural Journal

Vol. XLVII. No. 6 November-December, 1950

# Editorial

## Notes and Comments

RAMIE (*Boehmeria nivea*).

A brief summary of information on the agricultural aspects of fibre production from *Boehmeria nivea* has been received from R. R. W. Sievers, of White Waters Estates (Pty.), Ltd., Pretoria.

Ramie belongs to the nettle family (*Urticaceae*), and is grown commercially for its bast fibres, which have a very great tensile strength, as can be seen from the following table.

| | Ramie | Hemp | Flax | Silk | Cotton |
|---|---|---|---|---|---|
| Tensile Strength | 100 | 36 | 25 | 13 | 12 |
| Elasticity ..... ..... | 100 | 75 | 66 | 400 | 100 |
| Torsion ..... ..... ..... | 100 | 95 | 80 | 600 | 400 |

To get the best results Ramie should be grown on fertile soil with a pH value of between five and six and on soil which has a high percentage of N. Good moisture and good drainage are also essential. Unless it is possible to irrigate the crop then it should be grown in the higher rainfall areas.

The crop is a perennial and requires planting only once in five to eight years. The land should be well chosen and well prepared before planting. Ramie is generally propagated by root cuttings (rhizomes) or from selected seed. The rhizomes are cut into pieces four inches to six inches long; this should be done in the shade. The pieces are planted three feet apart with an average of three feet between the rows. The rhizomes are dropped lengthwise into the furrows and covered with soil immediately. The planting depth is two inches to four inches. The soil should be damp but not wet for planting. Where no frost occurs and irrigation is available, Ramie may be planted any time. In the Union of South Africa it does best when planted in early spring so that the young plants are well established before the dry or cool season begins.

Usually it is sufficient to weed it for the first year after planting or until the spaces between the rows are fully covered—generally three to four hoeings are needed. Buds appear seven

to ten days after planting and care should be taken to keep farm animals, especially fowls and pigs, out of the fields. About four months after planting stalks vary from one to three feet and appear rather stunted. These are cut down and left on the field for humus. The same thing happens with the second cut eight months after planting. With the third cut the stalks should have reached their maximum height—six to seven feet, and this will be the first harvest, generally about 60 to 75 days after planting. Harvesting time is indicated by the browning from the base of the stem up to a height of 2 inches to four inches. It is not advisable to delay harvesting until a larger percentage of stalk reaches the proper height as lignin develops if the plants are left after this time and the market value decreases. Usually three harvests are obtained per year and plantations reach maximum production in about three years.

In small plantations sickles or an ordinary mowing machine are used, while on big plantations special binder-type machines which mow and tie the stalks into bundles are used. The latest machines cut, defoliate and decorticate the stalks in one continuous operation while moving through the field.

The grower is only concerned with the yield of raw fibre and forage. The raw fibre has still to be degummed, and this is generally done by the spinning mill. Well degummed Ramie fibre is soft, pure white, and has a lustre like silk.

The following average yield on three cuts per year can be expected:—

| | | |
|---|---|---|
| Total green material harvested | 24-28 | tons p. acre |
| Leaves and tops (forage), green | 12-14 | ,, ,, ,, |
| Stalks, green weight | 12-14 | ,, .. .. |
| Raw fibre, air-dry basis, machine decorticated | 0.5-0.6 | ,, ,, .. |

A Ramie crop takes a lot out of the soil, therefore fertiliser requirements will be heavy.

The report ends with a discussion on the processing of the fibre and prices to be expected.

Quotations received from locally produced Ramie fibre ranged from £130 to £161 per ton c.i.f.; therefore it seems safe to assume the price will stabilise itself between £130 and £140 per ton, depending on quality. It must be clearly stressed, however, that the crop needs abundant water and it is very heavy on fertilisers.

Two Views of the Nest of the Angola Rock Thrush.

# Angola Rock Thrush

*Colonocincla angolensis niassea.*

By Capt. G. L. JAMES.

The Angola Rock Thrush is distributed from Angola across to Portuguese East Africa extending south to Mashonaland. There are few records of this rare and beautiful bird having been collected or seen over this large area. This may be partially due to shyness and a dislike of being molested. The nest and nesting habits are practically unknown.

The finding of a nest, near Salisbury, in *Brachystegia* woodland, on the 17th September, 1950, was an occasion of high expectation to obtain details of the birds' family life.

The nest was placed in a cleft in a tree (*Lannea discolor* Engl.) some five feet from the ground and contained three unmarked greenish-blue eggs (measurements: 2, 25 x 17.5; 1, 25 x 18 mm.) As will be seen from the photographs the nest greatly resembles that of a Black Flycatcher even to the material used—bents and tendrils lined with rootlets. The interior was shallow.

The female displayed extreme shyness leaving the nest when an intruder was some 60 yards away, and remained concealed in the foliage of a nearby tree. The male showed considerable courage in defence of his establishment, approaching within 10 yards and perching low down on a branch from which it captures insects on the ground, often, but not always, returning to the same perch with its prey.

The nest was again visited on the 24th in company with Mr. R. A. Jubb, who was able to confirm identification of both the nest and the bird. As on the previous occasion the hen left the nest when we were some distance away and remained concealed until 20 minutes after we had left the site and hidden behind trees.

Hopes of obtaining valuable information died on this visit when the nest tree was found to have a piece of "tembo" fastened round it, from which two nooses hung over the entrance to the nest. The trap was removed.

This is an excellent example of the difficulty of protecting wild life from the native. What could we do! Camp nearby and maintain a constant watch on the site! Not being in a position to do this, it is not surprising that on our next visit on the 24th, the nest was found empty and deserted. Moreover, the woods were searched then and on subsequent occasions, but no trace could be found of the birds, who appeared to have deserted the area.

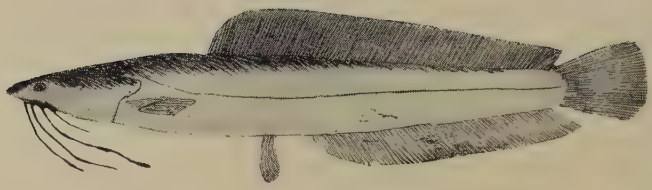
The name of this species is a misnomer, as they are not necessarily confined to rocky country, but from records available appear to prefer woodlands.

These birds are, as reported by Marshall in 1900, who obtained a specimen near Salisbury, insectivorous, the stomach of one he shot contained small *Coleoptera* (beetles), grasshoppers and black ants.

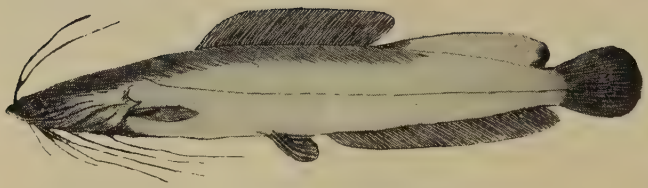
The male has the entire head, all round the neck and the back, slate-blue, appearing much lighter in strong sunlight; the crown is slightly mottled with black. Wings, dove-grey marginated with black; the upper and lower tail coverts are rufus barred with black, while the breast is chestnut paling to white on the abdomen.

The female is similar, but the head is mottled black on white and the breast is much paler than that of the male. The eyes are brown; bill and legs blackish in both sexes.

Two large "Vundu," Zambesi Valley.



Common Barbel (*Clarias* sp.)



Vundu (*Heterobranchus longifilis*).

# Some Notes on Freshwater Fishes in Southern Rhodesia

PART VI.

By R. A. JUBB, B.Sc.

There are a considerable number of species of freshwater fish which are described as "naked"; this means that they have no scales on their bodies. Another characteristic is that they have long sensory organs or barbels on the lips and chin. Collectively these fish are known as "cat-fish," but, in South Africa certain species are more commonly known as "barbel." Scientifically the cat-fish common to our rivers are represented by two main families—the family *Clariidae* and the family *Bagridae*.

To the family *Clariidae* belong the slimy, bewhiskered cat-fish known as barbel, easily recognised by the long barbels, the flat bony head, and the long dorsal and ventral fins. These fish are widely distributed and are found in all rivers and impounded waters. They all have a special air-chamber above the gill which acts as a kind of lung and enables the fish to remain out of water for many hours and to exist in mud for many months. It has been reported that these fish take advantage of heavy dew or wet ground to travel short distances overland; this may account for the mysterious manner in which they have populated most of our dams.

All barbel are predators and play a most important part as scavengers in large rivers and lakes, but in the shelter of small streams and dams they themselves are protected from predators and they are a dead loss to farmers who want to stock their dams. Barbel prey on the young fish and interfere with the nests. In unrestricted waters they are reputed to grow to a length of over five feet and weight up to 100 lbs. In dams they appear to breed rapidly and become a serious problem.

Barbel are preyed upon by other fish such as tiger-fish and eels and by crocodiles, otters and the magnificent fish-eagle. The more popular fishing resorts are entirely free of these animals, and it is quite easy to understand why the barbel has become such a menace by virtue of its numbers which even organised barbel competitions cannot keep down. The eradication from or control of this fish in impounded waters is a problem which cannot be easily answered at present, certainly netting is not satisfactory as the fish sounds and gets well away in the mud. As a temporary measure baited night lines can be used with large hooks and liver of ox heart as bait. Barbel tend to come into the shallows at night, and an experienced African trapper can usually produce some good results with a fish trap of chicken netting.

Most Africans eat barbel and need no encouragement to assist in getting rid of the fish. To the European eating of barbel flesh is an acquired taste, probably depending to a great extent on the water from which the fish was removed. You cannot compare the taste of a well-cooked barbel taken from the Zambesi River, for instance, with that of the same species taken from the Makabusi! Where dried fish is an important African industry, as along the Zambesi River and the shores of Lake Nyasa, barbel are eagerly sought after for the fat and oil which is obtained by rendering down and used for curing of other fish. The slimy barbel has its uses—but not in a dam for fish-farming purposes.

Belonging to the same clan we have the family *Bagridae*, which includes some of the more athletic types of cat-fish, the species range from heavy-weights to those which do not exceed six inches in length. Species of this family are distinguished from those of the previous family by the rounder body and the adipose dorsal fin in addition to a much shorter dorsal fin than the barbel has.

The "Vundu," *Heterobranchus longifilis*, common to the Zambesi and its larger tributaries, is well known as a heavy-weight, and specimens of 60 to 80 lbs. have often been caught on a variety of baits using heavy tackle. This fish sticks to the deep pools and does not appear to come very far into the smaller rivers. The difference between the barbel and the vundu is shown in the sketch of two typical species. As far as is known, the vundu does not make its way into dams and is therefore not considered as vermin; on the contrary, it is an excellent fighter on occasions and provides a good meal for the camp boys.

None of the species of cat-fish is in any way of use for breeding for food purposes, and prospective fish farmers should consult the Fisheries Officer before stocking a dam with fingerlings of *Tilapia* or Black Bass and avoid the possibility of feeding a lot of barbel which have got themselves well established—first.

Young peach trees with galls on crown and roots.

# Crown Gall

## A WARNING TO GARDENERS AND GROWERS OF DECIDUOUS FRUIT.

By JANE BROADFOOT, B.Sc.,
Branch of Botany and Plant Pathology.

A number of cases has occurred recently where young deciduous fruit trees and roses have been found infected with Crown Gall, a bacterial disease which gives rise to lumps of tissue at the crown of the plant, either just below or just above ground level. Sometimes these galls are formed on roots, branches or at graft unions. The disease can be serious on young plants, but on old trees usually does not do much damage unless the actual crown is attacked, when death may take place after trees come into full bearing. It is a most undesirable disease to introduce into new orchards.

The bacteria from the galls can live in the soil for a number of years, infecting healthy trees which may be planted in it. No guaranteed method is known of freeing such soil from them.

The disease is common in Union nurseries and is also known to occur in some Rhodesian nurseries. The Union authorities make every effort to prevent nurserymen by regulation from sending out diseased trees, but it is believed that some nurserymen are still supplying diseased stock.

It is almost certain that in some cases mentioned above the disease was present on the plants when they were received for planting, so that growers of deciduous fruit trees, raspberries or roses on a large scale, are strongly advised to obtain their stocks from reliable nurseries only.

All plants should be examined on arrival, and if any galls are found, the suppliers and the Branch of Botany and Plant Pathology, P.O. Box 25, Causeway, Salisbury, should be informed. The galls are easily seen if all soil is removed. Unfortunately the absence of galls does not mean that the trees are free from infection, and for this reason great care is necessary in the selection of the supplier.

Soaking the roots for two hours in copper sulphate (7 oz. to 20 gallons water), therefore, is advised as a precaution and may reduce the chances of infection considerably.

Growers who want more information on this disease and its prevention should write to the Chief Botanist and Plant Pathologist, Box 25, Causeway, Salisbury.

# Beetroot and Boron Deficiency

By C. N. HAYTER, Horticulturist.

For some time it has been noticed that all is far from well with the growing of beetroot (*Beta vulgaris*) in Southern Rhodesia. Even in soils where fairly high fertility has been built up and good crops obtained with other kinds of vegetables, beetroot in some instances have been almost complete failures and some market gardeners have almost given up growing the crop.

**General Symptoms.**

The first signs of trouble are usually noticed when the seedlings are about six weeks old, when their leaves begin to turn pale yellowish-green, losing their rich reddish-green colour and succulence. Growth tends to be much slower and the leaves eventually become much smaller than normal and are quite narrow.

The older leaves die early, and the new ones which replace them are distorted and have very short stems. In extreme cases these new leaves form rosette-like arrangements and are quite stunted.

**Root Appearance.**

The beetroot themselves exhibit large black sunken patches or cankers on the outside, particularly at the widest part of the swollen root—as shown in the accompanying photographs—while cracks may also appear.

When this disease occurs seriously in infertile soils, growth is very slow and roots about a third to half the normal size are produced. These beetroots are very unattractive and exhibit an aged appearance. When cooked, they require approximately double the normal time to get them sufficiently soft to eat, but never become really well cooked.

From observations made of beetroot, grown and supplied to markets in the Salisbury area, it would appear that at least half the growers are experiencing this trouble in some of their types of soil. It is also prevalent in other parts of the Colony, including Melsetter.

**Deficiency Disease.**

Having taken over a garden at Highlands some two years ago, the writer was faced with this beetroot trouble to quite a serious extent. The soil in question was a clayey vlei loam.

It was noted from work carried out overseas that boron plays a very important part in the growth of beetroot. Usually a deficiency of this minor element causes an internal breakdown, but it was also found that it can cause external blackened areas as described, without having the internal symptoms.

Effects of Severe Boron Deficiency, showing Arrested Growth, Deformed Foliage and Roots. (Photo. approximately one-third normal size.)

[Photo. by Public Relations.

Boron Deficiency Cankers on Normal Sized Beetroots.

[Photo. by Public Relations.

From this information, therefore, it was decided to try out boron applications and all sowings of beetroot seed were given a dressing of boric acid powder. This was applied immediately after the seed drills were filled in with soil at the rate of ¾-ounce per 100 feet length of row and over the row itself. A portion of each seed sowing was left untreated as a comparison control. In all, ten seedbeds were treated and the effect was most striking. Wherever boric acid powder had been applied, the beetroot was quite normal and healthy with a complete absence of blackening and cankers. The untreated portions of seedbeds showed all the deficiency troubles as previously.

**Further Trials.**

Following this experiment, boric acid powder was applied to seedlings in other beds. It was found that this treatment was equally successful provided it was given before the plants were three weeks old. It should be pointed out that grown in fertile soil, adequately supplied with water, beetroots grown in summer are fit for pulling eight to ten weeks from the date of sowing, when they should be 2½ inches to 3 inches in diameter.

Borax was then given to different beds at 1⅓-ounces per 100 feet row length with the same good effect, but better crop results were obtained in all instances where 1/5th ounce per square yard (approximately 60 lbs. per acre) of borax or 40 lbs. of boric acid powder per acre was broadcast dry over the whole area and then watered in.

**Soil Tests.**

Unfortunately, it was not possible at the time of the experiments to ascertain the pH values of the soil, but it was later found that where the beet had been grown the pH values varied between 6.5 and 7.5.

It is generally understood that as the acidity of the soil decreases and the alkalinity increases, so the minor elements become almost unavailable as plant food. For this reason it is most important not to apply lime or wood-ash to soils until soil tests have been carried out and recommendations made.

Boron deficiency is rather less pronounced where adequate water supplies are available, as the plants are then able to produce a much greater root system enabling them to obtain their food supplies from a larger soil area.

**Excess Boron.**

The writer followed up the treatment of boron application with other horticultural crops in adjoining plots of the same soil type where previously turnips, rhubarb and cauliflower only grew very poorly.

Numerous replications were carried out and the usual controls left as comparisons. In every instance where boron had been applied, the effects were most striking and healthy crops were obtained.

It had also been noticed that cauliflowers refused to form white curds; instead yellow centres were produced which were completely unsuitable for food. The first applications of boron lightly applied to the seed-beds caused no marked improvement and larger amounts of boron up to an equivalent rate of 80 lbs. per acre of agricultural borax were applied to two outside rows of cauliflowers two weeks after being transplanted to their cropping position, while a centre row was left untreated.

This rate of application proved too heavy and toxicity was readily shown some three weeks later, although small white curds were finally produced.

After the cauliflower crop, the soil was given a light dressing of garden compost plus 1½ ounces per square yard of N.P.K. vegetable fertiliser and sown to beetroot.

The plants came away excellently and gave a perfect beet crop, one of the best the writer has grown. The usual control plot was very poor and stunted. Potatoes following the beetroot cropped well without any toxic symptoms; similar results were obtained from a following bean crop. After a six months' fallow, a small portion of the same ground has again been sown with beet to test for the residual boron effect.

**Second Borax Treatment.**

Recent American research suggests that a second borax treatment is generally not necessary until a further two or three years, or until deficiency symptoms or analyses indicate such a need.

With continual cropping, especially under irrigation, boron may also become leached out. In the writer's soil it was noticed that rhubarb again showed deficiency symptoms six months after the first application.

**Boron No Cure-All.**

Attention should be given to the fact that applications of boron are by no means a cure for all vegetable ills. Carelessly applied, much harm can be done to soils, making them toxic to many crops and necessitating treatment to restore them to fertility again.

Boron is a chemical element, but as it is not available in the pure state, borax or boric acid are used.

Borax contains 11.34 per cent. boron while boric acid contains 17.49 per cent. boron.

*SUMMARY*

1. Beetroot is a difficult crop to grow in Southern Rhodesia particularly in soils with a pH value of 6.5 to 7.5 Many roots exhibit large black cankers and arrested growth.

2. Applications of boric acid powder at ¾ ounce per 100 feet of row were tried out on seed beds, with a portion of each bed untreated. In every instance the treated portions gave perfectly healthy beetroot. Further trials were carried out on seedlings with equally good results provided the applications were given before the plants were three weeks old.

3. Borax was then tried on different beds at $1\frac{1}{3}$ oz. per 100 ft. of row and also broadcasted at 1/5th oz. per square yard. The latter method gave the best results.

4. These results indicate that when it is difficult to grow beetroot even where normal cultural operations are carried out, the cause may be due to boron deficiency. Toxicity may result to following crops if the boron is carelessly applied.

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# Native Labour in Agriculture

(This report by Mr. V. W. Wadsworth summarises the results of the second part of a survey of labour use and mechanisation in agriculture. It deals with the maize farming group and should be read in conjunction with an introductory section and a report on labour on tobacco farms, which appeard in the May-June, 1950, issue of the "Rhodesian Agricultural Journal." These explained the assumptions on which the enquiry has been based. The field work for this report was carried out by Mr. J. D. Hopley, of the Economics Branch.)

## SECTION VII.

### GENERAL ASPECTS OF LABOUR ON MAIZE FARMS.

**Crops.**—The records used for this part of the enquiry were obtained from farms located in all the principal maize-growing areas of the Colony, and all the farms in the group obtained at least 50 per cent of their total cash income from direct sales of maize. The farms varied in size from 500 acres to 22,000 acres, with an average for the group of about 2,900 acres, as compared with the average for the tobacco group of 4,600 acres. But although the average maize farm was much smaller than the average tobacco farm, the older development of the maize areas and the lower profitability of this type of farming as compared with tobacco, were reflected in the greater acreage of arable. These farms showed an average of 631 acres under cultivation as compared with only 268 acres in the tobacco group. Maize was clearly preponderant in all cases. Two farmers grew no other crop whatsoever, and 17 others grew only a green crop in addition to maize. The remaining 61 grew small acreages of various other crops. Thus 12 growers had amongst them 348 acres of cotton; a further 23 had a total of 776 acres of tobacco; 10 of them grew in all 68 acres of potatoes; and 37 cultivated a total of 808 acres of groundnuts. The average summer cropping of the 80 farms studied was:—

| | |
|---|---|
| Maize (for grain) ..... ..... | 345 acres. |
| Maize (for silage) ..... ..... | 8 ,, |
| Green Manure ..... ..... ..... | 181 ,, |
| Legume Hay ..... ..... ..... | 36 ,, |
| Groundnuts ..... ..... ..... | 12 ,, |
| Tobacco ..... ..... ..... ..... | 10 ,, |
| Cotton ..... ..... ..... ..... | 5 ,, |
| Other Crops ..... ..... ..... | 34 ,, |
| | 631 acres. |

With 56 per cent. of the total arable acreage devoted to maize production, the heavy dependence of the group on this crop is most marked. Indeed, if maize were not the subject of price and

market guarantees, the relatively small cultivation of other cash crops (9 per cent.) so far practised would not make for economic stability. As it is it does not permit of maximum efficiency in labour utilisation.

Of the farms studied, only three had under 100 acres of maize; 11 fell into the 100-200 acre group; 16 produced maize on from 200-300 acres; 37 grew from 300-400 acres; and 13 cultivated over 400 acres. Two principal rotations are current, on the poorer or more exhausted soils maize generally follows green crops in alternate years. Elsewhere this rotation has been extended to maize, maize, and greencrop, with side-crops filling in as convenient and on smaller acreages. Where tobacco was grown this was usually produced on land cleared and broken up specifically for the purpose, and not on the ordinary arable lands.

**Livestock.**—Stocking on these farms was numerically about the same as on those in the tobacco group, though obviously more intensive, owing to the smaller size of the farms. Over the whole sample, the average stocking was as follows:—

| | | |
|---|---|---|
| Dairy Stock | | 11 |
| Beef Stock: | Cows | 65 |
| | Followers | 55 |
| | Other | 36 |
| Fat Stock | | 7 |
| Work Oxen | | 48 |
| Equines | | 2 |
| Sheep | | 48 |
| Goats | | 3 |
| Pigs | | 35 |
| Poultry | | 117 |

This is the equivalent of 179 stock units per farm, as against 178 stock units on the far larger tobacco holdings. Indeed, the greater relative emphasis on livestock goes far to redress the unbalance of the farming system so far as the arable is concerned. The group included 18 small dairy herds, mostly producing cream, 22 pig producers, and 9 beef fatteners. All these activities are useful corollaries to maize production, both from a mixed farming and a labour-spread point of view. None of these enterprises figured significantly in the tobacco group.

**Labour Force.**—To maintain the stock shown above, these farmers kept an average of eight natives. This represents one native for every 25 stock units as opposed to one for 35 in the tobacco sample. The difference is readilly accounted for by the type of stock kept, dairy cows and pigs both having a relatively heavy stock requirement.

As compared with 73 boys per farm or 3.6 acres per boy employed on crops in the tobacco group, the average in the maize group was 35 boys per farm or 18 acres of crop per boy employed. All the above figures are shown in boy-equivalents. In actual practice there was an average of 40 boys and 6 picannins regularly employed on all types of work—the equivalent of [illegible] boys. In addition 14 women and picannins were employed per farm on

a casual basis. These represented eight male adult equivalents or one casual labourer to every 78 acres of crop. In contrast with the employment of one casual for every 713 acres of crop on the tobacco farms, the lower dependence on a floating force is most marked.

**The Source of Regular Labour.**—It has been recorded in the case of tobacco farms that there is an alarming dependence on alien natives for the maintenance of the farm labour supply. The position is even more serious on maize farms, 28 per cent. only of the total labour force on the farms examined having been recruited from local sources, 72 per cent. of the total natives employed came from outside the territory. Five of the farmers visited had no indigenous labour whatsoever.

The labour force on these farms, however, had been much more stable than that on the tobacco farms. Whereas on the latter only 17 per cent. had been with the farmer more than three seasons, on the maize farms the corresponding figure was 37 per cent. A further 53 per cent. was in the second or third season, and only 10 per cent. was new. This factor has two distinct aspects. In the first place it probably reflects the fact that 44 per cent. of the total adult males had their wives and families with them, as against only 18 per cent. in the tobacco group. It was borne out that the farmers with the most stable labour forces were those carrying the highest percentage of men with resident families. The desirability of a stable labour force from the point of view of efficiency calls for no further comment. In the second place the position is extremely disturbing in that it reflects the serious decrease in the recruitment of new labour to this group of farms.

**Type of Work Performed.**—As was the case on the tobacco farms, 90 per cent. of the labour on maize farms was described as general. But again we found men employed according to acquired specialist aptitude and in a few cases there was evidence of actual and painstaking training in work with livestock. It is still clear, however, that far too much reliance is being placed on the native as a gang worker. His skill, such as it is, is usually either inherent, or acquired without any methodical instruction. He is hardly ever regarded as other than an untrained and unintelligent labourer, or as capable of anything better.

**Casual Labour.**—All except nine farms employed casual labour. In one case the source of supply was the local jail, two farms drew their supplies from neighbouring Reserves, and the remainder had a supply of women and children from their own compounds. An average of 14 persons was employed as casuals. Employment of casual labour varied from one to six months in the year with an average of two months. The type of work in which this casual labour was employed varied considerably. In a number of cases it was stated to be employed solely in connection with "side" crops, whilst in others it was employed wholly on tobacco work.

Generally casual labour is switched where the need is most pressing, and in this group work included picking cotton, reaping beans, reaping and bagging groundnuts, planting, cleaning, and reaping maize.

**Hours of Work.**—The general opinion was confirmed that the hours of work on maize farms are substantially longer than on tobacco farms. On six farms six hours was the general rule. Fourteen farmers reckoned on seven hours, and 26 on eight hours. Ten farms had a nine hour day and 24 worked ten hours or longer. Moreover there is no question here of seasonality. These hours are worked six days a week, 50 weeks in the year. As in the case of the tobacco group, however, the figures shown above can be reduced by at least one hour per day to cover meal breaks and to arrive at actual working time.

**Wages.**—Wages were in all cases paid both in cash on a monthly basis and in kind.

The average cash wage paid to boss boys was £3, about the same as on tobacco farms. This, however, was a fairly steady figure whereas on the tobacco farms we came across payments of £5. The only other differential payment was made to tractor drivers, for whom the wage rate has varied at between £2 and £3, with an average of 50s. For general labourers the highest cash wage recorded was 45s. (an isolated case). The general rate was found to be 32s. 6d., with about 25 per cent of the farmers paying 35s. There was less differential payment than on tobacco farms, but apart from this factor the general wage level was much the same, though, as has been noted, the rate per hour was lower due to the longer hours worked.

Far more variation was found in the conditions under which casual labour was employed. 30 per cent. paid women 1s. per day and picannins 6d. per day plus food. A further 2 per cent. paid 1s. 6d. per day and no food, whilst another 10 per cent. paid only 9d. per day plus full rations. The remainder paid their casual labour on a piece-work basis. Typical harvesting rates of frequent occurrence were 1s. per bag groundnuts, 3d. per 10 lbs. seed cotton, 4d. per bag beans, 2d. per bag mealies.

On every farm visited, regular labour was paid on a combined ticket and piece-work basis. The normal ticket is 30 days with a weekly pay-out on completed tickets. In 41 cases an annual bonus of from 8s. to 10s. was paid to satisfactory workers at the end of the harvest. 29 farmers were operating the deferred payments system for Nyasaland labour.

**Wages in Kind.**—Except in one instance where the ration issue consisted of 16 lbs. of mealie meal per week and 1s. 3d. in lieu of other rations, the food position was the same as on the tobacco farms. There was, however, no sugar issue, and the issue of part rations to the non-working wives of married boys was rare. Regular free issues of soap or tobacco were also rare.

Housing was provided in all cases. On one farm the quarters were of brick under asbestos. In all other cases, houses were of pole and dagga. In 14 cases the provision was described as in

every way satisfactory, and in 14 more as "tumbledown." The remaining compounds consisted of huts in the condition usually associated with native farm compounds.

As in the case of the tobacco farms, we found the practice of advancing cash to employees very widespread. Indeed on no farm was indebtedness absent. The highest amount known to be involved was £7, with £4 being quite common.

It was found that some farmers are under the mistaken belief that by advancing large sums of money workers are tied to the farm until they have paid off their debts. They little realise that the debtor can at any time give one month's notice to terminate his contract and that the practice of advancing large sums of money often leads to desertion when the burden becomes too great.

Thirty of the farms ran a farm store and five had farm schools with teachers. Almost all farms provided rough medicinal and first aid facilities. Six farms made issues of working clothes. Christmas gifts were the rule on 65 per cent. of the farms, and most farmers allowed ample garden facilities for the use of the compound.

**Labour Shortage and Method of Recruitment.**—In respect of casual or seasonal labour only 14 farmers, or under 18 per cent. complained of a shortage, and in all these cases the additional requirement quoted was small.. It will be observed that this factor is closely linked with the presence in the compound of a high proportion of families.

The position with regard to permanent labour was, however, very different. Exactly half of the farmers complained of serious labour deficiencies for their present commitments, and a further 20 per cent. stated that no additional development was possible. It is likely that this state of affairs accurately reflects the fact that this type of farming, especially in areas in close proximity to tobacco areas, is probably unpopular from the labourers' point of view. Thus, whereas recruited labour is the exception in the tobacco group, in this group it is the rule and over 50 per cent. of the farmers had labour recruited either by the Rhodesia Native Labour Supply Commission, or obtained as rejects from the Witwatersrand Native Labour Association. This recruited labour accounted for virtually all the new labour on these farms. Whilst there was a preponderance of voluntary labour overall, this had invariably been on the farms for a number of years.

## SECTION VIII.

### LABOUR UTILISATION ON MAIZE FARMS.

**European Labour.**—Two of the farms visited were run by two men in partnership, the remainder being one-man farms. Sixteen farmers each employed a manager, i.e., only seven less than in the tobacco group, but whereas the latter group employed 45 assistants on 35 farms, here there were only 18 assistants in employment. Eleven pupil farmers were employed, all on tobacco. Two coloured workmen were employed. The rates of pay for

managers varied from £30 to £50 per month plus bonuses of from 10 per cent. to 30 per cent. of profits. Keep and accommodation was provided in addition. This position is very much in line with that on tobacco farms, as is that in relation to assistants. Here the scale of pay varied from £15 to £30 per month usually with a small annual bonus in addition.

Again close scrutiny was made into managerial practice. In 25 per cent. of cases this was described as satisfactory. The higher managerial standard on this type of farm is probably due to the greater diversity and the impelling need for the farmer's own labour in most branches of his enterprise. But the general position is still unsatisfactory. In 5 per cent. of cases supervision was regarded as hopelessly inadequate, and in 70 per cent. of cases would only be regarded as "moderate to slack." No body of men complains more loudly about the inefficiency of native labour than the farming community. They can expect little else so long as the guiding strength is lacking at the top.

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The native labour position was carefully investigated on the basis of the labour efficiency standards described in full in a previous report (May-June issue of the "Rhodesian Agricultural Journal"). 48 per cent. of the maize farms investigated were clearly short of labour—a total deficiency of 253 boys. The remaining 52 per cent. had an apparent labour surplus—a total of 510 boys. (It will be recalled that the tobacco group showed a deficiency on 37 per cent. of farms—320 boys, and a surplus of 63 per cent.—1,403 boys.) In six of these cases the farmer did not agree that he suffered from any shortage, and in all these cases it was found that he exercised relatively close supervision. In all other instances the farmers expressed agreement with our assessment of the position.

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It may be said that, taking this farming group as a whole, it does not suffer at present from any serious overall labour deficiency. Indeed, over all, there is an apparent surplus. The group is, however, steadily losing ground in competition with tobacco farming, and with industry, and many farms are already genuinely and seriously short. It is possible here that the position may be eased by increasing mechanisation.

## SECTION IX.

### MECHANISATION ON MAIZE FARMS.

Complete mechanisation of maize growing from the ploughing to the bagging stage is now possible. In this connection a successful experiment was carried out during the 1948-49 growing season on the Government Experimental Farm at Gwebi.

A 65 acre field was ploughed by means of a 25 h.p. D.2 Crawler Tractor pulling a three-furrow disc plough. Its performance was recorded on an hour-meter as 109 hours for the full job, or an average of about 3/5ths of an acre per hour. Forty-three more hours were taken up by the application of 200 lbs. of fertiliser

per acre turned in to a depth of four inches by a one-way disc. The land was then left until four days after the first suitable planting rains. Germinated weeds were then killed by pre-cultivation with two eight inch disc harrows attached to the Multiple Hitch, a matter of 16 hours' work. A four-row maize planter with alternate hoppers then planted the maize at eight inch intervals in rows six inches to eight inches apart in 17 working hours.

When the plants were four inches to six inches in height the young maize was cultivated by attaching four extended spring-tooth harrow sections to the Multiple Hitch. In spite of the fact that the smallness of the plants reduced the speed of cultivation in order to prevent burying, four six inch to eight inch rows could be cultivated in one operation and the whole acreage only took 11 hours to cover.

The second cultivation was carried out in exactly the same way in eight working hours, there being no danger of burying.

The third cultivation was performed by using the front section of a six foot six inch Tandem Disc harrow with the outside discs removed so as to minimise any damage to the plant roots. The discs were set so as to throw up a ridge against the maize plants, this having the effect of smothering the small weeds growing in the rows and at the same time, by giving added support to the plant, minimising wind-blown maize lodging. (This operation, weather permitting, is best performed when the plants are waist high.) The Crawler used, kept in fourth gear, covered the whole 65 acres in 20 hours, both in the initial and the repeat cultivation.

A total of 40 hours were employed in giving two effective light cultivations for Witch Weed, using an extended section of a spring-tooth harrow.

The harvesting, witnessed by a large gathering of farmers, was entirely mechanical, and although three different Maize Pickers were tested in a demonstration alongside, a single-row maize picker was used for the experiment. This worked very successfully while the maize had an 18-20 per cent. moisture content, but once the moisture content dropped below this level the stalks became too brittle for successful picking. This operation involved 66 hours and the entire work on the crop a total of 350 hours.

It is appreciated that an isolated example of this kind is of little significance, and it is known that, in so far as the farm growing under 300 acres of maize is concerned, full mechanisation would not be economic unless the picking could be done by contractors. But the thing is now a practical possibility. Hybrid maize is more suited to mechanical harvesting than the longer-stalked varieties, and owing to the increasingly acute labour situation, mechanical picking may become imperative for the large growers. But even short of this final development, there is ample scope for mechanisation.

The balance of technical and farming opinion accepts the need for labour economy at the ploughing, planting and harrowing stages, and maintains that such economy is a pre-essential of any further development.

On average there were two tractors per farm, though in detail three farms used only ox labour, whilst one farm had five tractors, one had four, and ten had three. Thus there were more tractors than in the tobacco group. This is partly due to the substantially large acreages handled and for the rest is due to the heavier soil types. The capitalisation in tractors was, however, lower at £172 per 100 acres than in the tobacco group (£366). Most of the tractors were relatively old models in comparison, but the main reason for the lower capitalisation per 100 acres is to be found in the fuller and more efficient utilisation of the tractors available. Over three-quarters of the farmers used tractors for more than 50 per cent. of their arable work.

The total capitalisation in machinery was £536 per 100 acres in this group as compared with £708 in the tobacco group. A range from £1,322 at one end to £202 at the other end was noted.

Just under half of the farmers contacted stated that they did not contemplate any further degree of mechanisation, whilst the remainder were expanding.

**Recommendations.**—There can be little doubt that the labour position on maize farms, though not yet generally acute, is deteriorating. Conditions of employment compare unfavourably with those offered on tobacco growing farms, particularly in respect of hours of labour, and the supply of new labour, in particular, is uncertain. In the face of the superior attractiveness of other fields of employment there is little that the maize producer can do in obtaining labour, but he can, and must, do more to ensure that he retains his existing supply and use that supply to greater advantage.

The greater stability of labourers settled with their families is too great to be ignored, and the provision of adequate housing and garden facilities, and minor social amenities such as farm stores, schools, and clinics have been proved to be great inducements in this direction. This, combined with basic training of labour and sympathetic but firm supervision would seem to provide a great part of the answer over the next few years. For the rest, maize growing is a most promising field for effective mechanisation. Farm incomes are good and stability is assured. "Mechanisation now" should be the slogan of the maize grower who does not wish to be out of production in a few years' time.

# The Production of Fire Cured Tobacco

By J. C. COLLINS, B.Sc. (Edin.)
Government Tobacco Officer.

In 1949 a detailed study was made of the methods of production employed by growers of fire-cured tobacco in Southern Rhodesia, and the full report entitled "A Survey of the Fire-Cured Tobacco Industry" was published for sale by the Fire-Cured Tobacco Standing Committee.*

The work was repeated during the year 1950, so that data is now available for a crop grown under severe drought conditions and also for one grown under normal rainfall. As cultural and curing practices did not differ fundamentally during the two seasons, no attempt is being made to re-describe individual methods; but, instead, the methods which appear to give the best results have been selected and are described hereunder. Newcomers to the industry, however, are advised to read the original report in conjunction with this.

**Soil.**—Production is at present centred almost exclusively in the Shamva-Poti Valley Area, but there is no reason why the crop should not be grown successfully in those other parts of the country where soil, rainfall and altitude are suitable.

Under Southern Rhodesian conditions the best results have been obtained from clays and clay loams, but sandy clay loams, provided they are fertile and very fine-grained, are also capable of producing good quality tobacco. In fact, it is this type of soil which is selected for fire-cured tobacco in Nyasaland (see Appendices 1 and 2). Compared with similar Southern Rhodesian soils, however, the Nyasaland sandy clay loams as shown in Appendix 2 have a higher nitrogen and phosphate content.

Based on the results of examination and analysis of soil samples taken during the years 1949 and 1950, there appears to be a very marked correlation between quality and the calcium content of the soil. As the calcium content increases so the quality of the cured leaf appears to improve. Even at the highest levels reached (33.0 and 30.0 mgm. e.q. %) there has been no evidence of any lime deposit on the surface of the leaf.

These observations indicate the necessity for the immediate investigation of the effect of initial acidity on the calcium and magnesium requirements of the fire-cured tobacco plant.

* "A Survey of the Fire-Cured Tobacco Industry," by J. C. Collins; Price 5s. Obtainable from the Secretary, Fire-Cured Tobacco Standing Committee, Tipperary, P.O. Shamva.

In the appendix to this article will be found tables showing the analyses of typical fire-cured soils in Southern Rhodesia and Nyasaland; these are being published so as to form a useful basis of comparison for growers who have had their own soils analysed.

**Altitude and Rainfall.**—As production has been more or less confined to the Shamva-Poti Valley Area, not much data is available in regard to the range of altitudes within which fire-cured tobacco can be grown successfully under Rhodesian conditions; but, based on the results of trials conducted by farmers in other parts of the Colony, it is safe to say that altitudes of 2,000 to 4,000 feet are satisfactory, with the optimum being in the neighbourhood of 3,000 to 3,500.

Although experience has shown that fire-cured tobacco is capable of withstanding severe drought, and under such conditions will produce a remunerative crop, whereas maize will tend to become a failure, it is advisable that production be restricted to the 30 to 40 inch rainfall belts.

**Seed-Beds.**—Standard seed-bed practices have been observed throughout.

**Rotation of Crops.**—In assessing the value of a crop rotation, there are so many factors involved, including the very important one of soil type, that it is impossible from a survey of this nature to determine which rotation is best suited to the production of quality and yield in fire-cured tobacco.

The following table depicts the position occupied by tobacco in the rotations practised on the different farms visited during the seasons 1948-49 and 1949-50:—

| | Number of Farms | |
|---|---|---|
| | 1948/49 | 1949/50 |
| Tobacco follows maize | 16 | 9 |
| ,, ,, a green manure crop | 3 | 6 |
| ,, ,, leguminous stubble | 3 | 3 |
| ,, ,, tobacco (2nd successive crop) | — | 2 |
| ,, ,, natural fallow | 1 | 1 |
| ,, ,, cotton | 1 | — |

Of the five best quality crops produced during 1948-49, three followed maize, one followed velvet bean hay, and one followed sunn hemp ploughed under. The corresponding figures for 1949-50 are tobacco following maize on four occasions and tobacco following a green manure crop (velvet beans) on one occasion.

**Spacing.**—Here again, owing to lack of field statistics, it is not possible to do more than generalise on the various spacings employed by growers. The extent to which each is favoured is shown in Table I.

TABLE I—SPACING.

| | Used by 1948/49 | Used by 1949/50 |
|---|---|---|
| 3-ft. x 3-ft. | 4 growers | 2 growers |
| 3-ft. 2-in. x 3-ft. 2-in. | 1 grower | — |
| 3-ft. 4-in. x 3-ft. 4-in. | 1 ,, | 2 growers |
| 3-ft. 6-in. x 3-ft. | 3 growers | 2 ,, |
| 3-ft. 6-in. x 3-ft. 6-in. | 5 ,, | 6 ,, |
| 3-ft. 9-in. x 3-ft. | 1 grower | — ,, |
| 4-ft. x 3-ft. | 3 growers | 3 ,, |
| 4-ft. x 3-ft. 6-in. | 2 ,, | 2 ,, |
| 4-ft. x 4-ft. | — ,, | 1 grower |
| 5-ft. x 3-ft. | 1 grower | — ,, |
| Alternating 3-ft. 6-in. & 4-ft. 6-in. x 3-ft. | 1 ,, | 1 ,, |
| Alternating 2-ft. 6-in. & 4-ft. 6-in. x 3-ft. | 1 ,, | 2 growers |
| Alternating 2-ft. 6-in. (reducing to 1-ft. 6-in.) & 4-ft. 6-in x 3-ft. | — ,, | 1 grower |

A spacing of 3-feet x 3-feet is generally considered to be too close for fire-cured tobacco. It is not the question of the incidence of disease which prompts this opinion but the question of the damage sustained by the plants during reaping.

One grower divided his field into two portions, the soil in each being similar in type, and on the one he used a spacing of 3-feet 6-inches x 3-feet 6-inches and on the other a spacing of 4-feet x 3-feet 6-inches. Each plot received the same fertiliser treatment, but unfortunately the dates of planting differed, so that the variations noted in the two sections cannot conclusively be attributed to spacing. However, the following observations were made:—

(a) In the plot with the wider spacing the plants were very much superior in general shape.

(b) Unfortunately the grower was unable to keep detailed data in regard to grades and yield, but he did observe that there was no significant difference in yield between the two treatments, and that though the lower leaves in the 3-feet 6-inches x 3-feet 6-inches spacing were slightly thinner in texture than the corresponding leaves in the 4-feet x 4-feet spacing, this difference did not apply to leaves from higher up the plant.

For convenience of reference, the remarks made in the report on the survey conducted during the season 1949 in regard to those spacings in which the distance between rows alternate whilst the spacing of the plants in the row remains constant, are repeated here, as again this season the same points have been observed:—

(1) There is no evidence of border effect. Special care was taken to see whether or not this would be the case. The plants grew well and without any tendency to rankness or flaring.

(2) Comparing a spacing of 3-feet x 3-feet with one in which the rows alternate at intervals of 2-feet 6-inches and 4-feet 6-inches whilst the distance between plants in the row remains constant at 3-feet, there are 700 less plants per acre in the latter treatment, representing a decrease of 14 per cent.

(3) As there is a "path" 4-feet 6-inches wide on each side of every set of two rows, labourers have plenty of freedom of movement and consequently losses through damage to the plants must be greatly reduced.

(4) In the preparation of the land for planting on ridges, the method of alternating the distance between rows in the manner indicated, is more economical than making ridges 3-feet apart, as it effects a saving of 35,000 yards of ridging in 50 acres.

The yardage of ridging is identical with ridges spaced 3-feet 6-inches apart.

(5) At the time of reaping, an economy in labour can be achieved by eliminating the necessity for waiters, as crates can be placed along the 4-feet 6-inches paths at intervals convenient to the reapers.

A spacing of this nature should most certainly be included in a programme for future research.

A point of academic interest is that in a spacing of this nature, even when the distance between the alternate rows is reduced from 2-feet 6-inches to 1-foot 6-inches there was no sign of white mould nor any increase in any other disease, even though the leaves were over-lapping and climatic conditions were at times ideal for the development and spread of disease.

Before leaving this section it is necessary to state that, in general, the grower normally assesses his requirements of artificial fertiliser on the acreage basis rather than on the number of plants per acre. In other words, a given quantity of fertiliser will be applied per acre regardless of what the spacing is.

**Manurial Treatment.**—In the report on the survey conducted during 1949, it was suggested that applications of less than 250 lbs. per acre of Standard Tobacco "B" Mixture (P.N.K. 13-3-8) might possible be inadequate. In the light of the studies carried out by the Southern Rhodesia delegation in Nyasaland during 1950, however, there is reason to consider that even 250 lbs. per acre might prove to be excessive and that the large dressings we are accustomed to giving in Southern Rhodesia might be one of the causative factors for the production of undesirably coarse midribs and veins.

In the absence of experimental data no recommendations can be made at this stage, but growers are reminded that it is funda-

mentally important that the growth of the tobacco plant should proceed steadily without any setback, and that this can best be achieved by giving the fertiliser in fractional applications rather than in one instalment.

The methods employed by twelve growers are summarised in Table II, which should be of particular interest as it takes into account soil type, soil fertility in relation to the three major constituents—nitrogen, phosphate and potash; the effect of the crop immediately preceding tobacco, and the rates and times of application of fertiliser. An explanation is required in regard to the first column "Quality of Crop." At the time of sale on the auction floors, particular attention was paid to the quality of leaf arriving from 21 different farms, and at the end of the season all 21 were listed according to their order of merit. Out of the 21 crops examined in particular only 12 are listed in the table, as no data on soil analysis is available for the remaining nine. The quality description in the column, however, is the position occupied by the crop in relation to all 21.

It is emphasised that the information contained in the table must be treated with great reserve and that no recommendations can be made until scientifically laid out experiments have been conducted.

The fact that crops of quality 14 and 17 were grown on very fine grained sandy clay loam and sandy loam should not be taken to mean that soils of this type are unsuitable for fire-cured tobacco. On the contrary, this is the type of soil on which fire-cured tobacco is grown in Nyasaland, and, in 1948-49 in Southern Rhodesia, a crop of very high quality was grown on a very fine grained sandy clay loam.

**Field Routine.**—This section really resolves on whether the crop is planted on the flat or on ridges or hills. Selection between ridges and hills is more a question of the personal choice of the individual, as there is no fundamental difference between them provided each is properly constructed. In making the choice, naturally the question of soil conservation must be considered.

The spell of continuous wet weather experienced during the transplanting stage in the season 1949-50 proved that planting on the flat can be very dangerous if such climatic conditions develop, as in every instance where this was done, the stand of plants was poor.

**Priming and Topping.**—It is a moot point as to whether or not the practice inaugurated by certain growers of leaving the primings or lowest leaves on the plant sufficiently long to approach ripeness for reaping and curing, is not one of the principal causes of such a high percentage of really low-grade leaf being offered for sale.

The persons who favour this practice aver that if there is a demand for this type of leaf, as apparently there is, why not sell it instead of throwing it away? It requires a series of carefully laid out experiments to determine whether such procedure is

TABLE II.

| Quality of Crop | Soil Type | SOIL N % | SOIL $P_2O5$ mgm eq % | SOIL $K_2O$ mgm eq % | Tobacco Follows | FERTILISER APPLICATION |
|---|---|---|---|---|---|---|
| 1st | Clay | 0.15 | Less than 1 | 0.3 | M | 100 lbs. per acre "B" Mixture in two applications (A). |
| 2nd | Clay | 0.17 | 1 | 0.2 | M | 100 lbs. per acre "B" Mixture before planting (B). |
| 3rd | Clay loam | 0.16 | Less than 1 | 0.4 | M | 200 lbs. per acre "B" Mixture in three applications (B+A). |
| 4th | Clay | 0.22 | 1 | 0.2 | GM (VB) | 350 lbs. per acre "B" Mixture in two applications (A). |
| 5th | Clay loam | 0.11 | Less than 1 | 0.3 | M | 75 lbs. per acre "B" Mixture in one application (A). |
| 7th | Clay | 0.11 | 1 | 0.2 | T | 150 lbs. per acre "B" Mixture in one application (A). |
| 8th | Clay loam | 0.12 | 4 | 0.2 | M | 200 lbs. per acre "B" Mixture in two applications (A). |
| 11th | Clay | 0.11 | Less than 1 | 0.5 | ½M ½GM(VB) | 200 lbs. per acre "B" Mixture in one application (A). |
| 12th | Clay loam | 0.11 | 1 | 0.2 | GM (VB) | 200 lbs. per acre "B" Mixture in two applications (A). |
| 13th | Clay loam | 0.10 | 2 | 0.3 | M | 200 lbs. per acre "B" Mixture in one application (A). |
| 14th | Very fine grained S.C.L. | 0.06 | Less than 1 | 0.2 | T | 200 lbs. per acre "B" Mixture (B+A); 50 lbs. per acre top dressing (A). |
| 17th | Very fine grained sandy loam | 0.07 | 1 | 0.3 | GM (SH+CP) | 200 lbs. per acre R.R.P. (B); 5-7 tons per acre KM (B); 400 lbs. per acre "B" Mixture; in two applications (B+A). |

A = after planting B = before planting SCL = sandy clay loam M = maize T = fire-cured tobacco CP = cowpeas
VB = velvet beans ploughed under RRP = raw rock phosphate GM = green manure crop KM = kraal manure SH = sunn hemp

really economically sound. Not only does the delayed presence of such leaves on the plant render it more susceptible to disease infection, but it also probably exerts a depressing effect in regard to yield and quality on the more desirable type of leaf higher up the plant.

Quite possibly the recent increase in the percentage of spotted leaf, so much disliked by buyers, is the outcome of this particular practice.

It is interesting to note that in Nyasaland the crop is primed high.

**Topping.**—Naturally no hard and fast rule can be made to apply to topping, as the operation is so dependent upon the standard of growth made by the plant and on seasonal conditions, but it is interesting to note the methods employed in the case of the five best quality crops grown in the two seasons 1948-49 and 1949-50. These are depicted in Table III.

The attention of growers is drawn to the fact that the stage at which the plant is topped is of as great importance, if not more important, than the height to which it is topped.

TABLE III—PRIMING AND TOPPING.

| *Quality of Crop* | *Extent of Priming at Topping Time* | *Stage of Topping* | *Nature of Topping* | *No. of Leaves Remaining* |
|---|---|---|---|---|
| | | 1948-49 | | |
| 1st | High | Between bud and full flower | Low | 10-12 |
| 2nd | Not primed | Full flower | Low | 12-15 |
| 3rd | Fairly high | Full flower | Fairly low | 13-14 |
| 4th | High | Early flower | Low | 8-10 |
| 5th | High* | Full flower† Bud stage‡ | Low | 10-12 |
| | | 1949-50 | | |
| 1st | Low | Early flower stage | Fairly low | 14-18 |
| 2nd | High* | Early to full flower stage | Low | 10-12 |
| 3rd | High | Early flower stage | Low | 9-12 |
| 4th | High | Early flower stage | Low | 10-12 |
| 5th | Low | Early flower stage | High | 14-18 |

* By priming a week after topping he finds that these primers cure better than if reaped at the time of topping.

† Early in season.

‡ Later in season.

**Seed Selection.**—It is interesting to note that very few growers purchased seed for the season 1949-50, as the vast majority had selected seed from their own crops. Two growers imported seed for themselves from Nyasaland.

Although growers are extremely conscientious in the manner in which they select seed plants, it is unfortunate that many of them are not sufficiently experienced in plant breeding to select really desirable types.

This question of seed selection is such an important one that the warning given in the report for 1948-49 is repeated here: "Whilst the industry is so localised and the number of growers so limited, the Fire-cured Tobacco Growers' Committee would be well advised to consider some scheme to ensure a measure of control over seed selection and disposal. This is an extremely important point and one which should receive early consideration, because once the industry expands and extends to other areas, the more difficult will it be to effect the necessary control."

**Harvesting.**—With the exception of two growers who harvest the whole plant by severing the stalk, all others reap the leaves individually. With increasing labour shortage, more and more growers are arranging their reaping so that the whole plant can be stripped of its leaves in one or two operations.

**Curing.**—The points emphasised in the 1948-49 report are equally applicable to the season 1949-50.

The individual methods employed by the growers of the three highest quality crops are described below:—

**Method No. 1.**—The barn is packed with the sticks spaced on the tiers at intervals of nine inches. Next, the ventilators and door are closed and the latter is sealed with "dagga" if it is not a close fit for the frame. The tobacco is allowed to yellow, which it does in five or six days. By the end of this period browning will have commenced and light smoke fires are then lit inside the barn, using maize cores as fuel. The top ventilators are opened one quarter, depending upon the condition of the leaf. Should the tobacco feel too moist, the ventilation will, of course, be increased.

The ventilators and door are opened for a few hours at four or five o'clock each afternoon during the colouring (i.e., the smoking) stage and are closed for the night.

Fires are not tended at night but are allowed to die down.

When the leaf has taken up full colour, the smoke fires are drawn and the midribs and web are dried with the aid of flues starting at a temperature of 110°F. As soon as the leaf appears completely dry the temperature is raised to 120°F.

The barn is allowed to cool for 24 hours, and the leaf is then brought into handling condition by spraying it with water from the top tier.

For preference this spraying is done in the afternoon, and as soon as the operation has been completed the barn is sealed and left till the following morning, by which time the leaf should be in suitable condition for removal to the bulking shed. If it is not, low pressure steam is introduced.

**Method No. 2.**—As soon as the barn has been packed the ventilators and door are closed, and the leaf is left to yellow with the temperature of the barn maintained at 90°F. with the aid of heat radiated through flues. No moisture is introduced into the barn.

When the leaf has yellowed and browning is fairly pronounced, which on an average takes eight to ten days, seven smoke fires art lit inside the barn, using for fuel, maize cores which have been soaked in water. Top and bottom ventilators are opened as soon as smoke is introduced.

The leaf is smoked for three days, and at the end of the third day the temperature is raised to 100° with the aid of flues and maintained at this level for about ten hours. It is then raised to 110° and held there for about twelve hours. All this time the smoke fires produce a light smoke and burn continuously throughout the day and night.

The next step is to remove the smoke fires and raise the temperature to 120° and then by increments of 5° every four hours to a maximum of 135° in order to dry out the midribs.

When the barn is at 135° the bottom ventilators are closed, and when the midribs of the leaves near the door and adjacent to the walls are beginning to dry, the top ventilators are also closed.

The leaf is conditioned for removal from the barn by spraying it with water.

**Method No. 3.**—At the beginning of the season the barn is so packed that the tobacco-laden sticks are spaced on the tier at intervals of approximately 10 inches, but towards the end of the season they are packed closer together at intervals of roughly 7½ inches.

The curing process resolves into wilting or yellowing the leaf for approximately four days, then subjecting it to smoke each alternate day until full colour is obtained, and then finally drying the web and midribs with open fires. It is interesting to note that the temperature within the barn is not lowered suddenly each evening by opening the ventilators and door for an hour or so as most growers do after the fires have been drawn, but is reduced gradually and automatically over a period of 24 hours with the ventilators and door closed.

The following chart is very typical of the method of curing employed by this particular grower:—

6th April: Barn filled. Ventilators and door closed. Leaf left to yellow for 4 days.

10th April: Commence smoking the barn by lighting four fires inside it producing a dense smoke from green timber. Draw the fires at night. The ventilators and door are not opened.

11th April: Barn kept closed. No smoke.

12th April: Smoke re-introduced, this time from six fires producing only a light density. The fires are drawn at night. The ventilators and door are not opened.

13th April: Barn kept closed. No smoke.

14th April: Smoke re-introduced, this time from eight fires producing a light density. The fires are drawn at night. The ventilators and door are not opened.

15th April: Barn kept closed. No smoke.

16th April: A light volume of smoke is produced again from eight fires which are drawn at night. The ventilators and door are not opened.

17th April and onwards: Fire the barn every day until full colour in the leaf is obtained. Then open the top ventilators and dry the midribs with open fires burning all 24 hours of each day for as long as is necessary. Flues are not used.

The leaf is conditioned for removal from the barn by using low pressure steam. However, if it is proving difficult to take up condition, it is lightly sprayed with water.

**Grading.**—There was a very marked improvement in the standard of grading during the 1949-50 season. The most common fault is the mixing of colours and particularly the inclusion of green with coloured leaf.

Lack of proper organisation in the grading shed is perhaps the main cause for the occurrence of faulty grading. There are several growers who allow their graders to squat where they choose on the floor of the shed, with the result that proper supervision becomes impossible and the percentage of discard is greatly increased. Tables are essential, and it is imperative to bear in mind that grading is very greatly simplified if the contents of each barn or, if leaf of similar type, is bulked separately.

During grading the factors to bear in mind are:—

1. Body and texture.
2. Colour.
3. Length.

As far as body and texture are concerned, fire-cured leaf should be divided into lugs, thin leaf and heavy leaf. The main divisions of colour are "light," "brown," "dark," "green," and "variegated." By "light" is meant leaf of cinnamon shade, and by "dark," leaf which is dark chocolate to almost black. Regarding "greens," differentiation must be made between "olive" and "raw green."

There is a very close correlation between body and colour, so that lugs and thin leaf normally fall into "lights" and browns," whereas heavy leaf is generally "brown" or "dark." Green is usually indicative of the leaf having been reaped before it was truly ripe.

On the basis of length, the leaf should be divided into the four groups, 24 inches and over, 20 to 24 inches, 16 to 20 inches, and shorts.

The main criterion is that the grower must be careful to see that each bale contains only leaf which is similar in body and texture, colour shade, and length range.

During the 1949-50 season there was a high percentage of spotted leaf offered for sale, and it is in the grower's interest to separate such leaf from sound leaf, as it has a tendency to tear in the spotted areas when being stripped, and in consequence detracts from the value of the sound leaf.

**Presentation for Sale.**—To much emphasis cannot be laid on the importance of submitting for sale bales which are neat and uniform. The action taken by the Fire-Cured Tobacco Growers' Standing Committee over the last two seasons, in reporting to growers on the quality and standard of manipulation of their individual consignments, has been responsible for the very marked improvement evidenced over the auction floors.

The two points still requiring attention are condition and tying. To show to advantage, fire-cured tobacco must be in slightly higher condition than flue-cured Virginia, but this does not mean that it should be wet.

As far as tying is concerned the main faults are:—

(a) Butts of hands too large, due to too many leaves being tied in a hand, or, as is more often the case, the butts not being tied firmly enough.

(b) The tie hand being not deep enough or else being too deep.

The butts should measure about one inch across and the binder or tie band should start at the extreme end of the butt and continue for one and a half to two inches up the hand. Bind firmly.

**Classification.**—In order to obtain more detailed information on the quality of the crop, a system of classification based on the American system was introduced on the auction floors during the season 1950 with the permission of the Tobacco Marketing Board.

Unfortunately the writer was the only person available for this duty, and as his time was also occupied by matters relating to other branches of the tobacco industry, it was not possible for him to attend all sales. Further, as the scheme did not come into operation until several sales had already been completed it was not found possible to classify more than eight per cent. of the total of 6,380 bales sold during the season. All sales conducted after the 23rd June, 1950, were ignored, as it was considered that consignments offered after that date were the tail end of individual lots and the prices obtained for them were out of all proportion to those received earlier in the season. To have included them would have distorted the true value per grade.

The figure of eight per cent. is too low to be really representative of the crop, but the information obtained is of sufficient interest to be included in this report. The procedure adopted was to classify every third bale on several sale days and, therefore, within this margin of eight per cent. the sample can be regarded as truly randomised.

| Leaf Type | Grade | No. of Bales | Price Range (pence per lb.) to nearest farthing | Assessed Average Price (pence per lb.) |
|---|---|---|---|---|
| LUGS | X1L | — | — | — |
| | X1F | 14 | 20—24$^{2}$ | 22.2 |
| | X1D | 4 | 22$^{2}$—24 | 23.0 |
| | X2L | 1 | 22$^{2}$ | 22.5 |
| | X2F | 21 | 9$^{3}$—20$^{3}$ | 18.6 |
| | X2D | 15 | 16—20$^{2}$ | 19.3 |
| | X3L | 2 | 15—15$^{3}$ | 15.5 |
| | X3F | 15 | 12—19$^{2}$ | 17.1 |
| | X3FV | 1 | 17$^{3}$ | 17.7 |
| | X3D | 23 | 10—20$^{2}$ | 16.7 |
| | X3M | 1 | 15$^{1}$ | 15.2 |
| | X3G | — | — | — |
| | X4L | 1 | 14 | 14 |
| | X4F | 16 | 12$^{3}$—15$^{1}$ | 13.4 |
| | X4FV | 1 | 13$^{1}$ | 13.2 |
| | X4D | 30 | 11—16$^{3}$ | 13.9 |
| | X4M | 1 | 12 | 12 |
| | X4G | — | — | — |
| | X5L | — | — | — |
| | X5F | 1 | 10 | 10 |
| | X5FV | — | — | — |
| | X5D | 4 | 10—12$^{1}$ | 11.5 |
| | X5M | 1 | 11 | 11 |
| | X5G | 4 | 8$^{3}$—12 | 10.2 |
| THIN LEAF | C1L46 | 3 | 29$^{2}$—30 | 29.6 |
| | C1F46 | 5 | 26$^{2}$—27$^{3}$ | 26.8 |
| | C1F45 | 1 | 25 | 25 |
| | C2L46 | 3 | 22—27$^{2}$ | 24 |
| | C2L45 | 3 | 20$^{2}$—27 | 23.3 |
| | C2L44 | 3 | 20—22 | 21 |
| | C2F46 | 36 | 17—28 | 24.3 |
| | C2F45 | 12 | 14$^{2}$—26 | 22.2 |
| | C2F44 | 1 | 21$^{3}$ | 21.5 |
| | C2D46 | 7 | 15—25 | 21 |
| | C2D45 | 4 | 14—27 | 22.7 |
| | C2D44 | 1 | 24 | 24 |
| | C3L46 | 1 | 24$^{3}$ | 24.5 |
| | C3L45 | 3 | 20—26 | 22.6 |
| | C3L44 | 2 | 19$^{2}$—21$^{3}$ | 20.5 |
| | C3F46 | 36 | 14$^{1}$—24$^{2}$ | 19.5 |
| | C3F45 | 34 | 11—27$^{3}$ | 20.1 |
| | 3CF44 | 9 | 16$^{3}$—20$^{3}$ | 18.0 |

| Leaf Type | Grade | No. of Bales | Price Range (pence per lb.) to nearest farthing | Assessed Average Price (pence per lb.) |
|---|---|---|---|---|
| THIN LEAF | C3FV46 | 2 | $13^2$—$16^1$ | 15.0 |
| | C3FV45 | 4 | 13—$20^2$ | 16.5 |
| | C3FV44 | 2 | $16^1$ | 16.2 |
| | C3D46 | 23 | 15—26 | 20.3 |
| | C3D45 | 14 | 15—$24^2$ | 19.6 |
| | C3D44 | 4 | 15—21 | 16.7 |
| | C3M46 | 1 | $14^1$ | 14.2 |
| | C3M45 | 3 | 18—21 | 20 |
| | C3M44 | 2 | 17—$22^2$ | 19.5 |
| | C3K45 | 4 | 12—$16^1$ | 13.2 |
| | C4L46 | 1 | $16^3$ | 16.7 |
| | C4F46 | 7 | $12^3$—28 | 16.1 |
| | C4F45 | 24 | 12—$27^2$ | 15.8 |
| | C4F44 | 5 | $12^1$—$19^1$ | 16.2 |
| | C4FV46 | 1 | 10 | 10 |
| | C4FV45 | 4 | 11—$15^2$ | 13.5 |
| | C4FV44 | 3 | 10—14 | 12.0 |
| | C4D46 | 14 | $11^3$—20 | 16.3 |
| | C4D45 | 30 | $12^2$—24 | 15.3 |
| | C4D44 | 19 | 10—18 | 13.8 |
| | C4M46 | 2 | 14—$15^1$ | 14.5 |
| | C4M45 | 3 | $13^3$—$15^2$ | 14.3 |
| | C4M44 | 1 | 12 | 12 |
| | C4G45 | 2 | 13—$13^2$ | 13 |
| | C5F45 | 1 | $13^3$ | 13.7 |
| | C5FV45 | 1 | 10 | 10 |
| | C5D45 | 5 | 10—$11^1$ | 10.6 |
| | C5D44 | 4 | 10—13 | 11.2 |
| | C5G46 | 1 | 6 | 6 |
| | C5G45 | 1 | 10 | 10 |
| | C5G44 | 1 | 12 | 12 |
| HEAVY LEAF | B2F46 | 1 | 22 | 22 |
| | B2F45 | 2 | 15 | 15 |
| | B2D46 | 1 | 24 | 24 |
| | B2D45 | 1 | $27^2$ | 27.5 |
| | B3F46 | 2 | $19^2$—$19^3$ | 19.5 |
| | B5F45 | 1 | $12^3$ | 12.7 |
| | B3D46 | 8 | 14—$21^2$ | 19.0 |
| | B3D45 | 7 | $12^3$—20 | 17.1 |
| | B3D44 | 5 | $12^1$—$19^1$ | 16.8 |
| | B4F46 | 1 | 13 | 13 |
| | B4F45 | 2 | 12—14 | 13 |

| Leaf Type | Grade | No. of Bales | Price Range (pence per lb.) to nearest farthing | Assessed Average Price (pence per lb.) |
|---|---|---|---|---|
| HEAVY LEAF | B4D46 | 1 | 14 | 14 |
| | B4D45 | 5 | 12—16¹ | 14.6 |
| | B4D44 | 3 | 16³—18 | 17.3 |
| | B4M46 | 2 | 15³—18 | 17.0 |
| SHORTS | T3F | 6 | 15²—20 | 17.6 |
| | T3D | 7 | 8¹—21 | 17.8 |
| | T3G | 1 | 13¹ | 13.2 |
| | T4F | 3 | 11—12³ | 12 |
| | T4D | 6 | 9—20² | 13 |
| | T4M | 1 | 12³ | 12.7 |
| | T4G | 1 | 10 | 10 |
| NONDESCRIPT | N1E | 18 | 12²—18 | 14.6 |
| | N1D | 3 | 14—14² | 14.3 |
| | N1G | 3 | 9²—12 | 10.3 |
| | N2E | 18 | 8—12³ | 9.6 |
| | N2D | 24 | 4²—13² | 9.6 |
| | N2G | 4 | 7—10³ | 9.5 |

From the foregoing it can be deduced that:—

Lugs constituted 30.1% of the crop with a price range of 10.2—23 pence.

Thin leaf constituted 43.1% of the crop with a price range of 6—29 pence.

Heavy Leaf constituted 8.1% of the crop with a price range of 12.7—27.5 pence.

Shorts constituted 4.8% of the crop with a price range of 10—17.8 pence.

Nondescript constituted 13.5% of the crop with a price range of 9.6—14.6 pence.

Scrap constituted 0.1% of the crop.

The outstanding features are the high proportion of lugs and nondescript leaf and the very low percentage of heavy leaf; and in turn, this observation emphasises the necessity for a detailed study to be made of the effects of priming at the correct time versus non-priming or delayed priming.

Another important feature borne out by this preliminary classification is that the official American grade classification is extremely well suited to Rhodesian leaf and does not require to be modified in any way. It is better to adhere to a recognised national system than to adopt the standard of grades employed by any one particular individual or commercial concern.

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The interest taken by the Trade Section has also been very much appreciated.

APPENDIX 1.

## RESULTS OF EXAMINATION AND ANALYSIS OF SOIL SAMPLES, SOUTHERN RHODESIA: SEASON 1949-50.

| | ABOVE AVERAGE CROP | | | | AVERAGE CROP | | | | | BELOW AVERAGE CROP | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Lab No. | 654/W | 649/W | 656/W | 650/W | 653/W | 652/W | 658 W | 648/W | 657/W | 655/W | 651/W | 647/W |
| Colour | Dark Brown | Dark Greyish Brown | Dark Brown | Dark Brown | Brown | Brownish Red | Dark Brown | Greyish Brown | Yellowish Brown | Pinkish Brown | Reddish Brown | Yellowish Brown |
| Soil Type | Clay | Clay | Clay Loam | Clay | Clay Loam | Clay | Clay Loam | Clay Loam | Clay | V. fine grained sandy Loam | Clay Loam | V. fine grained S.C.L. |
| pH (reaction) | 5.9 Med. Acid | 6.1 Slightly Acid | 6.2 Slightly Acid | 6.1 Slightly Acid | 6.1 Slightly Acid | 6.2 Slightly Acid | 6.0 Slightly Acid | 5.9 Med. Acid | 6.3 Slightly Acid | 5.8 Med. Acid | 6.2 Slightly Acid | 6.3 Slightly Acid |
| Nitrogen % | 0.15 | 0.17 | 0.16 | 0.22 | 0.11 | 0.11 | 0.12 | 0.11 | 0.11 | 0.07 | 0.10 | 0.06 |
| Calcium (mgm. eq. %) | 18 High | 22 V. high | 16 High | 24 V. high | 10 Normal | 22 V. high | 15 Normal | 8 Normal | 14 Normal | 7 Normal | 14 Normal | 4 Low |
| Magnesuim (mgm. eq. %) | 2.5 Normal | 4 Normal | 3 Normal | 5 Normal | 2.5 Normal | 5 Normal | 2.5 Normal | 5 High | 2.5 Normal | 1.2 Normal | 4.5 Normal | 3 Normal |
| Potassium (mgm. eq. %) | 0.3 Low | 0.2 Low | 0.4 Medium | 0.2 Low | 0.3 Low | 0.2 Low | 0.2 Low | 0.2 Low | 0.5 Medium | 0.3 Low | 0.3 Low | 0.2 Low |
| Phosphate (mgm. % of $P_2O_5$) | Less than 1 Very Low | 1 Low | Less than 1 Very Low | 1 Low | Less than 1 Very Low | 1 Low | 4 Low | 1 Low | Less than 1 Very Low | 1 Low | 2 Low | Less than 1 Very Low |

APPENDIX 2.

## COMPOSITION OF SOIL SAMPLES, NYASALAND.

(Information kindly supplied by Chief Agricultural Research Officer, Nyasaland.)

| Lab. No. | Depth ins. | Colour | Stones p.c. | Acidity pH | Moisture p.c. | Loss on Ignition p.c. | Clay p.c. | Silt p.c. | Fine sand by difference p.c. | Coarse sand (ignited) | Nitrogen (total) N p.c. | Organic carbon C p.c. | C.N. Ratio : 1 | Phosphate (available) P p.p.m. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 321 | 0-6 | Reddish brown | 1 | 6.2 | 1.8 | 8.9 | 26.4 | 7.8 | 27.4 | 36.6 | 0.13 N | 2.2 | 17 | 8 N |
| 325 | 0-6 | Dark brown | 1 | 6.5 | 2.1 | 8.0 | 25.3 | 9.9 | 20.0 | 42.7 | 0.12 N | 1.4 | 12 | 8 N |
| 327 | 0-6 | Reddish brown | 1 | 5.8 | 3.1 | 4.0 | 25.3 | 7.9 | 18.6 | 45.1 | 0.07 N | 0.9 | 13 | 2 XVL |
| 333 | 0-6 | Dark brown | 2 | 6.8 | 1.5 | 7.3 | 20.5 | 9.6 | 25.0 | 43.4 | 0.12 N | 1.8 | 15 | 8 N |
| 339 | 0-6 | Reddish brown | 1 | 5.9 | 2.2 | 9.6 | 33.1 | 13.6 | 18.8 | 32.3 | 0.14 N | 1.9 | 14 | 2 XVL |

All Sandy Clay Loams

# Irrigation in America

By R. H. ROBERTS, Assistant Director of Irrigation.

JULY—SEPTEMBER, 1950.

My visit was paid principally in connection with the proposed Sabi Irrigation Scheme and the establishment there of an Irrigation Experimental Station.

The objectives were two-fold:—

(a) To study irrigation developments and practices in the U.S.A., particularly under conditions similar to those of the Sabi Valley; and

(b) to endeavour to recruit soil scientists to advise on the development of irrigation in the Sabi Valley and to direct the experimental station for the first five years.

For purposes of publication, certain portions of my report, which are not considered of interest to the public, have been omitted, and the remainder of this article consists of extracts from the full report.

## PART I. NARRATIVE.

**Denver, Colorado** (July 29th to August 3rd). On Monday, July 31st, I made contact with the Bureau of Reclamation Regional Office through Mr. David R. May, who is stationed there and who visited Salisbury last year to advise on the Hunyani Poort Dam. After some discussions and arrangements, I visited the Bureau's Federal Centre, some miles out of Denver, where I met Mr. McClelland, the Chief Engineer of the Bureau. The Federal Centre has over 2,000 employees, and is the headquarters of the Bureau's design and research. I spent some time in the Hydraulics Laboratory, and saw many of the scale models under test. I picked up many practical points on the design and equipment of hydraulics laboratories, which will be valuable in designing our own. I saw other laboratory work, such as the "cavitation" testing machine, and the "plastic" workshop. I had discussions on the "vacuum process" for concrete surfaces, and on the design of earth-rockfill dams and canals.

Later, at the Regional Office, I had a brief discussion on economics and an interview with the Information Officer.

On Tuesday, August 1st, I drove to Fort Collins, 66 miles north of Denver, with two Agricultural members of the Reclamation Bureau. There I met Dr. Omar J. Kelley (B.P.I.S.A.E., in charge of Agricultural Research in the 17 Western States), and Dr. Gardner, Professor at the Colorado A. and M. College at Fort Collins. After discussing my problems, we made an extensive tour of the irrigated areas south and east of Fort Collins. Over 400,000 acres are under irrigation now, and new

projects are designed to increase this figure to some 600,000 acres. Rainfall is about 15 inches, mainly in winter, and agriculture is confined to about five to six months in the year. Farms are about 80 acres, and are very profitable, land being seldom for sale. There is a diversified agriculture, the principal crops being lucerne and other hay crops, sugar beet, maize, barley, beans, etc. I inspected a large plant for de-hydrating and grinding lucerne. The company owning the plant cuts the lucerne for the farmer, transports it to the plant in tip-trucks, weighs it, de-hydrates it in large cylinders heated by oil blast, grinds it to meal, bags it and loads it into railway trucks. There are many such plants in the State. The meal is used for poultry or dairy feed.

Irrigation is almost entirely of the surface type, either between borders or by small furrows ("corrugations"), and here I first saw siphon tubes of plastic or aluminium being used. They avoid creating "mud-pies" and produce a uniform stream at each point that water is applied. All land is meticulously prepared or levelled (which I found was almost universal in the States), so that labour for irrigating is reduced to a minimum, and "hired labour" is very seldom required.

At this stage it is perhaps appropriate to explain that in every large irrigated area in the U.S.A. the farmers are organised, by petition, into "Irrigation Districts," sometimes eight or ten districts in an area. The Irrigation District is a body corporate, and it raises its revenues by direct charges for water or, in its alternative form of a "Conservancy District," by rates levied on all property in its district. It may, and usually does, own or construct its own works, and it may contract with the Bureau of Reclamation or a water company for the supply of water from outside. **The Bureau does not therefore have direct dealings with individual farmers,** even when it is "operating and maintaining" the system in detail. The Bureau will contract with a "District" on the basis of two forms of payment: (a) the repayment of the assessed reimbursable capital costs of construction, and (b) the payment of annually assessed "operation and maintenance" charges.

In assessing the reimbursable portion of the capital cost, deductions are made from the total capital cost in respect of their assessed value for such national purposes as flood control, recreation and navigation, and also for electric power, if any.

On Wednesday, August 2nd, I was taken on a tour of the Colorado—Big Thompson Project, a series of works being built to produce additional water for the irrigated areas near Fort Collins. This project, briefly, is designed to collect water from the **western** slopes of the Rocky Mountains, and convey it to the **eastern** slopes, which are short of water. Water is collected in the Granby Dam, an earth-rockfill structure over 300 feet high. The reservoir is over 8,000 feet above sea-level, and has a capacity of 545,000 acre-feet and a surface area of 7,200 acres. Water is then lifted to a maximum of 186 feet by a pumping plant consisting of three 6,000 h.p. pumps housed in a seven-storey building, and delivered by a canal with a capacity of 1,100 cusecs to Shadow Mountain Dam and Grand Lake. At this point the Rockies are pierced by a tunnel 13 miles long, whence water is

delivered to the eastern slopes, down which it proceeds through a series of power-stations (sales of electric power will pay for most of the project), and it ends up in two great reservoirs at the bottom. One of these, the Horsetooth Reservoir, required the construction of four separate earth-rockfill dams. The total cost of the project is 151,000,000 dollars.

**Tucumcari, New Mexico** (August 5th). I called on Mr. Lyman, the "Project Manager" of the Bureau of Reclamation. After some discussion with him and his staff, I was taken to the local Agricultural Experimental Station, but unfortunately the irrigation work is still in its infancy, and there was little to see. In the afternoon I was taken by the "Water Master" on a tour of the project. The project is only three or four years old, and farming was often not of a very high standard, as the water users were frequently inexperienced. An interesting feature of the tour was the fact that every official car has a two-way radio set, so that the office and the travelling staff, including the 14 "ditch-riders," can speak to each other at all times, and the Water Master can give down-to-the-minute instructions to his ditch-riders, and receive their reports, which is of the greatest value in times of emergency, such as canal-breaks, apart from routine use for adjustments of flow, etc.

The Project is supplied with water from the Conchas Dam, on the Canadian River, built by the Army Engineers for flood-control, and therefore "non-reimbursable." The Project at present has reached over 30,000 acres, and is being expanded to 45,000 acres. Although a modern project, it was remarkable that practically no canal-lining was used, although losses have been considerable in some places, but have been reduced by the sealing action of the (frequently) muddy water. The Project is still being directly operated by the Bureau, and the Water Master was proud of the fact that, in spite of the length of the canals, he could meet "change of water orders" at 24 hours' notice, though he could require 72 hours' notice to be given.

During my tour I was shown a "Gradall" machine for cleaning canals, and also a number of the canal structures, including the "double gate" method of measurement. At one point the main canal is taken in a tunnel under the town.

Later in the afternoon Mr. Lyman took me out some 30 miles to see the Conchas Dam, a concrete overflow structure about 180 feet high, with earthen flank embankments totalling over three miles.

In the evening I caught a plane to Albuquerque.

**El Paso, Texas** (August 6th and 7th). On the 6th (a Sunday) I flew to El Paso from Albuquerque. On the 7th I called at the Project Office of the Bureau of Reclamation, and an Engineer of the staff was deputed to take me on a tour of the Project.

The Project consists of a series of dams, weirs and canals on the Rio Grande, extending into two States (New Mexico and Texas) and also involving international arrangements with Mexico. The Project had its beginnings over 200 years ago, when the

Spanish pioneers operated there, and it has developed now into a total irrigated area of some 173,000 acres.

Water is derived from the Elephant Butte Dam (pronounced "Bute"), built in 1916, and the Cavallo Dam (pronounced "Ca-vie-o"), built in recent years. Both dams were low at the time of my visit, after a poor winter's snowfall. The Rio Grande has become no more than a large canal, being controlled by the dams and confined by levees.

This is almost a "one-crop" project, about 70 per cent. of the area being under cotton, which is very profitable at present "support" prices. Lucerne (20 per cent.) and truck crops make up the balance of the area. Cotton yields an average of 1,000 lb. of lint (2 bales) per acre—a gross return of some 400 dollars per acre. The average size of the farms is 100 to 160 acres. Water rates were stated to average £2 11s. 6d. per acre. Cotton takes three acre-feet, and lucerne about four.

Mexican labour is employed generally, but is getting scarce. "Wet-backs," or illegal immigrant labourers, cause trouble to the immigration authorities, but find ready employment. Wages are 50 cents (3s. 6d.) per hour, and up.

I obtained some interesting literature on farm costs and incomes, relating to water charges and land units.

Drainage of the Rio Grande Project is accomplished by open drains, 10 or 12 feet deep, and spaced from a quarter mile to one mile apart.

They appeared to be operating successfully in these alluvial soils, but, like all open drains, present a problem in maintenance.

I saw an interesting machine cleaning weeds and mud from the canals. It spans the canal, running on caterpillar tracks, and it operates a chain of buckets, spilling on one side. It has to be reversed to clean the other side. This particular machine was 25 years old.

I saw no lined canals on this Project.

**Phoenix, Arizona** (9th August). On arrival from Tucson in the morning, I was met by a member of the Bureau of Reclamation staff, who took me on a tour of the Salt River Project.

Parts of this Project, which embraces 227,000 acres, suffer from a saline water and a saline soil subject to water-logging, and in many parts only certain crops, such as lucerne and barley, can be grown, but nevertheless they are being grown, and profitably grown. I saw lands being reclaimed. First, the clearing, levelling and "bordering." Then leaching with heavy waterings for about six months. Then a grain crop (barley) for a season. Then lucerne, sown in a stand of Bermuda grass which enables the lucerne to germinate. After the lucerne crop it is often possible to grow normal rotations.

Over a large area, water was once standing on the surface or only a couple of feet below it. (It still is, in some places.) Open drains were constructed but soon became ineffective. The only effective solution has been deep pumping. Boreholes 20 inches in diameter have been sunk in large numbers (often only a quarter mile apart) and give yields up to eight cusecs. This

water is highly saline (up to 5,000 p.p.m.), but it nevertheless is used after dilution with the canal water, which itself is about half as saline. (On alkaline lands, heavy waterings are used, up to eight acre-feet per acre, and it makes little difference how saline the water is, provided that it can get down.) The result of this heavy pumping has been to lower the local water table by 50 feet or so, and to enable thousands of acres to be used.

Nevertheless, the high salinity and the threat of water shortage is creating an increasingly serious problem, and the area is looking forward to receiving fresh water from the Colorado, through a projected pumping and canal scheme.

Lucerne yields of five to six tons, and barley yields of about 30 bushels, are obtained. Hay crops, vegetables and grain sorghums are largely grown. The feeding of livestock is a very important industry.

There are many good citrus orchards and date gardens. Dates may be of interest in the Sabi, as they produce a very high return of food per acre, but the rainfall in the Sabi may be too heavy. Palms are planted about 30 feet spacing each way, and will often yield 200 to 300 pounds of dates per palm. Some of the varieties grown here and in California are the Deglet Noor, Halawi, Khadrawi, Hayani, Maktoom, Medjool and Bahri. Dates require hand labour for pollinating, trimming leaves, thinning the fruit, and picking (often using ladders). I saw the process of fumigating, drying and storing the dates after picking.

**Yuma, Arizona** (10th August). I had a discussion of the Sabi Scheme with Dr. Converse and some of his colleagues, and then visited the Experimental Station and the Projects.

There are two Projects, one in the "Valley" and one on the "Mesa" (pronounced "May-sa"). The Valley Project is an old one, and farming is carried on intensively on fertile soil, but which suffers from a high water table. Open drains are used, and water is pumped back to the canals. Crops are of the general type, with a large acreage of vegetables, and some citrus, vines and dates. The word "mesa" is properly applied to a table-land (flat-topped hills), but is here used for a great bench or terrace of soil some 30 feet above the Valley level. This soil is of a very open textured sandy type, and consumes excessive amounts of water, up to 15 acre-feet per acre. The early settlers, who received Colorado water by canal benefited by the deposition of a foot or more of silt, but the Boulder Dam now traps the silt, and the water going on to the land is clear. Citrus and vines (the latter now of a nematode-resistant type) are extensively grown, and there is also general crop farming. Holdings on the Mesa are often small, 10 or 20 acres (of citrus).

Dr. Converse then drove me a considerable distance up the Gila Valley (guttural "G"), where extreme shortage of water and excessive salinity are telling their tale, and few farms are left. Water is pumped from deep wells, and often contains as much as 7,000 parts of salt per million. I met one of the few successful farmers, who comes out by growing lucerne for seed. An interesting point here is the importance of bees in pollinating

the blossoms, and although opinions differ, it is held that bees can make the difference between a yield of 150 lb. and 600 lb. of seed per acre. Bee-farmers co-operate with lucerne seed-growers.

A large Project is under construction to supply the Gila Valley with water pumped from the Colorado (salinity 700 p.p.m.).

**Imperial Valley, California** (11th-13th August). The Imperial Valley is the area south of the Salton Sea, and runs from slightly above sea level to 240 feet below. The area surrounding the Salton Sea is extremely interesting. It was once a part of the Gulf of California (a high water mark is clearly to be seen on the hill sides, but differs slightly from present sea level), but was cut off by the delta of the Colorado, and was later a fresh-water lake. It had dried up, however, when settlement started, until floods breached the banks of the precariously-poised Colorado at the point where the old canals took off, and the waters of the Colorado poured down into the Salton Sea, creating two river channels and the present sea, which is 30 miles long by 10 miles wide. The breaches were repaired, largely by the Southern Pacific Railroad, and since then the Colorado has been tamed by the series of dams starting with Boulder Dam, and almost completely diverted into the All-American Canal. Yuma was once a sea-port, but is now inaccessible to boats, as there is practically no water left in the river below it.

The Valley comprises about 500,000 acres of irrigated lands, administered by the Imperial Valley Irrigation District, which contracts with the Bureau of Reclamation for water supplied through the All-American Canal. The Valley is highly productive, growing rich crops of lucerne and sugar-beet, and very large acreages of vegetable and truck-crops, of which lettuce and cantaloupe are the most important, lettuce especially so.

The total value of production in 1949 was over 92 million dollars (£32,000,000). The average size of the farms is just over 100 acres each.

Vegetable growing concerns usually lease land for one or two seasons, and will normally insist on its having been under lucerne for at least three years. The feeding of cattle is done on a large scale, usually by big operators, who own the cattle and stall-feed them in yards with feed grown or purchased locally. It gave one an insight into what could be done through the growing of lucerne on a large scale in the Sabi Valley, not only to improve the beef produced by the present ranches but also to bring about an improvement in the quality of the breeds which could be ranched if lucerne was available through the winter.

The soils of the valley are of the heavy types, including "Imperial Clay," and water-logging is an ever-present danger.

I spent an afternoon at the Soil Conservation Service office, where I was told of the excellent results which had been obtained with tile-draining. Over 100,000 acres have been "tiled," so successfully that last year for the first time more salts were removed from the entire Valley than entered it. I obtained particulars of the technique that is used. A rotary trenching machine is employed, which digs the trench (about six feet deep)

and draws through it a "shoe" or shield within which the tile-layer works.

Hoppers in the "shoe" supply gravel below and above the tiles, and a strip of "malthoid" is drawn over the tile. A bull-dozer follows the machine and back-fills the trench as they go along. Contractors undertake the complete job at all-in charges varying from 30 cents (2s. 2d.) per foot for 4-inch tile to 40 cents (2s. 10d.) for 8-inch tile, or about 60 to 85 dollars per acre for 6-inch tile. Concrete pipes are used. Special attention must be paid to settling the backfill and to the outlets. The trenching machine is made by the Buckeye Co. of Ohio, and by other firms, including a local firm (J. L. McElvany, Box 261, El Centro), which also makes the "shoe" for attachment to standard trenching machines.

I should have mentioned earlier that I was met at El Centro by Mr. E. G. Noble, of the Brawley Experiment Station, a man with 35 years' experience of Yuma and the Imperial Valley. He took me to the County Commissioner and the County Agricultural Agent, and to the Irrigation District Offices. Here I was told something of the history of irrigation in the Imperial Valley. At present the charges for water made by the District amount to an "operation and maintenance" charge of about 6.00 dollars for four acre-feet, plus an annual assessment of five to six dollars per acre for capital repayment, based on a rate of 3.50 dollars per 100 dollars valuation. The District maintains an efficient "operation and maintenance" organisation, and can make "changes of water" orders effective at 24 hours' notice. Water orders are collected daily by ditch-riders (often by notes clipped to gates) and by telephone and other channels, centralised at the Head Office and relayed to Imperial Dam over 80 miles away, where the inflow to the All-American Canal is regulated by the Bureau of Reclamation.

Mr. Noble motored me to the Imperial Dam, which is a large diversion work. Water leaves the Dam in four interconnected canals, three of which are switched into the De-silting Works, which cover 80 acres, and consist of six large basins, in which the sand settles, is kept moving by a series of slowly-rotating agitators and is sluiced from under back to the river. The clear water overflows the side weirs of the Basins into the Canal proper. The fourth canal mentioned above is a by-pass. The Canal at the time of my visit was carrying 11,000 cusecs, and is designed for about 15,000. Apart from its size, the Canal is also remarkable for being unlined, although it passes through "Mesa" formations. One section passes through huge sand dunes, which however lie above the "mesa" formation.

Imperial Valley is of course intensely hot. The rainfall averages 3 inches per annum, and rain is considered a nuisance.

Houses in this part of the States are universally equipped with "coolers," usually of a type reminiscent of the "Charcoal safe" employing the evaporation principle, and fitted with a powerful "squirrel cage" fan, which draws air through the cooling panels (filled with a type of wood wool) and blows it into the house, being usually fixed to a window. These devices could

readily be manufactured at small cost in Rhodesia, and should be attached to houses in the Sabi Valley and other places where the heat is not accompanied by humid conditions. Under humid conditions it is necessary to use an expensive "air-conditioning" plant.

**Coachella Valley** (14th August). Mr. Noble motored me to Indio in the Coachella Valley. This valley is the counterpart of the Imperial Valley, but lies north of the Salton Sea. It is in process of being supplied with water by means of the Coachella Canal, a branch of the All-American Canal. The present acreage under irrigation is 30,000 acres, which is being expanded to 78,000 acres.

The value of raw irrigable land is from 100 to 300 dollars per acre. The main Canal is concrete lined, and is protected against being damaged by run-off from the hills to the east by means of an enormous dyke or embankment, with occasional floodways across the Canal. Distribution is by means of pressure pipes, including one eight feet in diameter across the Valley.

The most interesting feature of the visit to Coachella was the extremely good work that is being done to measure and record underground water levels prior to, and during, the development of irrigation. This work is being done by the Bureau of Reclamation in collaboration with the Department of Agriculture staff at the Salinity Laboratory at Riverside. It consists of sinking 2-inch cored holes on a 2-mile grid, and "jetted" holes (called "piesometer wells") at intermediate spacing not more than one mile apart and frequently less. The piesometer wells can be put down cheaply by a special machine, to depths of 50 or 60 feet, through the soil and sub-soil. With practice, the operator can log the formations encountered (clay or sand, etc.) by the feel of the machine. The holes are lined with $\frac{3}{8}$-inch pipes. The process will be described in a bulletin to be published shortly, and I asked for a copy to be sent.

Careful records are kept, and maintained, of the water levels in all holes, and in this way the initial level of the underground water, and its subsequent behaviour, can be closely mapped. Any danger spots are immediately apparent, and can be dealt with. One such area of 400 acres had been tile-drained, resulting in the removal of a flow of 400 gallons per minute.

This careful, but not costly, work appealed very greatly to me as the rational approach to the problem of drainage. It is far better than anything I encountered elsewhere.

**San Joaquin Valley** (18th August). On the morning of the 18th we visited Mr. George Harrison, of the Shafter Experimental Station. He has done a remarkable job of cotton breeding, and his new strain 442, which is now compulsory for California, has some excellent qualities, among which is its remarkably high tensile strength, over 90,000 lbs. per square inch. Cotton is extensively grown in parts of the San Joaquin Valley, usually three or four crops following lucerne, and with interim crops of potatoes and sugar-beet. He described something of the technique of the deep wells which supply most of the water, depths

down to 2,000 feet, but usually about 600 feet, diameter 14 inches, yields 500 to 3,000 gallons per minute. Water levels have, as is well known, dropped very seriously in the San Joaquin Valley. At Shafter a drop of 80 feet has occurred in the last three years.

Commenting on the danger to cotton of stainer beetles in the Sabi Valley, he said that, while that particular pest was not known in America, he felt that it should be susceptible to control by modern insecticides, applied by aeroplane, as is so commonly done in California. He confirmed the opinion that I had previously obtained, that cotton could not be successfully matured as a winter crop in the Sabi Valley, in the light of the recorded temperatures. Mr. Harrison showed me the very excellent instruments being used for testing the cotton fibres, two made by the University of Tennessee and one by a manufacturer at Tucson.

Land values (under irrigation) near Shafter are as high as 1,350 dollars (£500) per acre, and water often costs as much as 50 dollars (£18) per acre per annum.

In the afternoon we visited the Tulare Lake area, a remarkable region, originally a lake, but in the last century dried up by the diversion of the rivers feeding it. On several occasions, however, heavy floods have filled the "lake" again, submerging as much as 100,000 acres to a depth of 15 or 20 feet. In between floods, this huge flat area of heavy black clay soil is farmed by large operators, such as the J. G. Boswell Company. Cotton is the chief crop. To reduce the salt menace, the water is kept low in the canals, and is pumped by huge portable units into the field furrows. Everything is on a large scale. In some areas, one man on a bull-dozer acts as an irrigator, turning on the water by "dozing" down the bank of the furrow! East of the lake area, on the higher land, I saw some of the Company's wells, 1,800 feet deep, and delivering as much as six cusecs each. One was equipped with a 200 h.p. motor. The water table hereabouts has apparently dropped about 140 feet in the last 30 years. The "Friant-Kern" Canal, under construction, is intended to relieve the position.

The Company's engineer told me that water cost them an average of six dollars (42s.) per acre-foot (water is partly from the rivers and partly from wells). Cotton required 2.5 acre-feet, and barley 1.0 acre-feet (the latter applied in one watering).

On the 19th I flew from Bakersfield to Berkeley (San Francisco), and had a good opportunity of seeing the intensive cultivation carried out under irrigation in the San Joaquin Valley. The Valley is flat, 50 miles wide, and 250 miles long—only a portion of this great area is irrigated, and the rest is barren desert.

**Sacramento Area** (22nd August). Mr. Gardner motored me to this area, in the southern part of the Sacramento Valley, which is the northern part of the "Central Valley" of California.

At Davis, near Sacramento, I called at the University of California College of Agriculture, and spent some time with Dr. Veihmeyer, who is a world authority on the soil-water-plant relationship. He has done an immense amount of work on this

subject, and presented me with a great deal of literature. He strongly emphasised two points—"do not disturb the soil by over-cultivation; leave it alone as much as possible; do not sub-soil it"; and "farmers use too much water."

I was anxious to get information on the rice-growing which is extensively practised near Sacramento, but was unable to see Mr. Davis, the University expert. However, Mr. Gardner and I sought out some large rice-fields and examined them.

In California, unlike the East, rice-growing requires practically no hand labour. Contour banks ("checks") are put up at vertical intervals of two or three inches, and are most irregular in shape, as is well shown in my aerial photographs. The lands are then most meticulously levelled by tractor and "land-plane," the latter being on the principle of a road-grader but 60 feet long. Small weirs are installed in the checks to control the water level, and to enable surplus water to proceed from one field to the next. The lands are then flooded to a shallow but uniform depth, and are seeded by aeroplane. They are then kept flooded, no hand labour being employed. They are drained of water in due course, and when the land is dry enough the crop is reaped by a special "combine." The area used for rice-growing in the Sacramento Valley consists chiefly of the "sloughs" or flood channels which were occupied by the river before it was confined by dykes. They are of an impervious nature. Rice is principally grown by large landowners or corporations.

**Columbia Basin**—Washington State—(23rd, 24th 25th and 26th August). On the afternoon of the 23rd I proceeded by air from Sacramento to Yakima, in the Columbia Basin. On the way I had a good view of the Shasta Dam, at the head of the Sacramento Valley.

I was met in the evening at Yakima, and motored some 50 miles to Prosser, in the Yakima Valley (the Yakima River is a tributary of the Columbia).

The Agricultural Station at Prosser is jointly staffed by the B.P.I.S.A.E., the State College and the Soil Conservation Service. Members of the staff also conduct research on the "development farms" which have been set up elsewhere in the Columbia Basin. Mr. Singleton, of B.P.I.S.A.E., is in charge of the Station, and he proved most helpful to me. I met several members of the staff, and particularly Dr. Viets, who works on plant nutrition and soils, and who conducted me over the Prosser Station.

The Basin consists of largely undulating land, much of the soil being wind-blown, or derived from lava flows. The corrugation method of irrigation and sprinklers are both used.

The standard five-year rotation is: three years lucerne (seeded with spring wheat), one year potatoes and one year maize or sugar-beet. With a seven-year rotation there would be an additional year of lucerne, and sugar-beet as well as maize.

I spent some time with Mr. Mech, of the Soil Conservation Service, who was carrying out some very interesting experiments. The land was divided into two plots; the corrugations in the one were steep (7%) and in the other much flatter (2%). Crops

in the standard rotation were grown on the plots, and careful measurements made of the varying amounts of water applied, of the surplus water and silt loss. The different rates of application of water were based on certain percentages of the "available" soil moisture, which was measured by sampling and direct analysis. Mr. Mech gave me literature on the subject.

One of his main conclusions was that by watering at less frequent intervals both water and labour were saved, with no reduction in yield. I told Mr. Mech that I was glad to have his figures, but that I was not surprised at his results, which were in accordance with our own opinion! Mr. Mech employed a sampling tube of ¾-inch pipe, with the lower end expanded and then reduced at the tip. A "hammer" was used for driving the tube in. I was impressed with the very careful way in which this experiment was being conducted.

On the 25th, Mr. Singleton and Dr. Viets motored me to two of the "development farms" in the Columbia Basin.

There are several types of development farm in use by the Bureau of Reclamation, and I obtained literature comparing the merits of each type, but most people I saw agreed that the Columbia Basin type was the best.

The basic idea is to have a specimen farm operated by a farmer, and not by a Government Agency. The psychological advantages are obvious.

Briefly, the Bureau selects a typical farm, lays it out for irrigation and even plants crops such as lucerne, puts up the necessary buildings (including a cottage for visiting officials), provides domestic water (a great problem in the Basin), and supplies the necessary implements. A suitable farmer is then carefully selected, and offered the farm on lease, subject to certain conditions, of which I have particulars. He is guaranteed a basic income, and 60 per cent. of the net profit beyond that income. He is required to give facilities for research, and to allow members of the public to see over the farm.

The scheme appears to be most successful. The idea is to start it some years before water will be supplied to the area, so that the results obtained will be available to new settlers. I discussed the scheme with the two tenant farmers I met, and found them well satisfied with the arrangement.

The Pasco Development Farm, which I visited, is 40 acres in extent, and the crops grown are sweet corn, potatoes, maize, lucerne, sugar-beet, and beans. About six dairy cows are kept. Water is supplied at a charge of four dollars for 3¼ acre-feet, any additional water being charged on a sliding scale, at a sharply increasing rate. The farmer agreed that 3¼ acre-feet was "about right." Agriculture is, of course, not possible in the winter. Some zinc deficiency experiments were in progress.

The Moses Lake Development Farm is 80 acres, and the same crops are grown. The farm was larger as the soil was poorer. The soil was only about 18 inches deep, overlying gravel and cobbles, and appeared to be of a porous type, but actually was most impervious and had given a great deal of trouble in attempting to get any penetration of water.

We proceeded northwards to Ephrata, where Mr. Singleton handed me over to the Bureau of Reclamation people. Ephrata is the centre of the development of the Columbia Basin Project. This is a project to irrigate over 1,000,000 acres, by means of water pumped from the Grand Coulee Dam. The water is collected in the "Equalising Reservoir," 27 miles long, formed by building two dams across the valley known as the Grand Coulee and then led into a system of huge concrete-lined canals spreading both to the east and the west.

The million acres of irrigable land have been selected out of about 2½ million acres available.

The development of the million acres of irrigation is planned on a schedule providing for about 70,000 acres to be brought under irrigation each year. Even the Bureau of Reclamation, which is used to large projects, is somewhat worried about such a rate of development!

They have, however, in this project profited from earlier mistakes, and have made a most exhaustive study of the soils, extending over some 13 years. Mr. W. W. Johnston, who has been in charge of all this preliminary work, arranged for me to be given a considerable amount of literature, which should be of the greatest value in planning the development of the Sabi Valley.

The work in the Columbia Basin is closely shared by a number of Federal and State agencies, and is the outstanding example of co-operation between, and co-ordination of, these several agencies.

During the late afternoon I was taken out to see something of the engineering construction work, and was fortunate enough to see the process of concrete-lining the West Main Canal. I also saw the Soap Lake Siphon, which is 25 feet in diameter and two miles long, and the Bifurcation Works, where the East Canal takes off.

On the 26th I was motored up the Grand Coulee, and saw the Equalising Reservoir under construction. Arriving at the Grand Coulee Dam, I was given a guide, who showed me over the Dam in general, and in particular the installation of the remaining turbine-generator units and the 12 enormous pumping units.

In the evening I took a bus to Spokane.

**Boise, Idaho** (27th, 28th and 29th August). I proceeded to Boise (pronounced "Boy-see") by air on the 27th, a Sunday.

On the 28th I met Mr. Nelson, Regional Director of the Bureau of Reclamation, and some of his staff. After some discussion of our problems, I was taken out for the day to see irrigation developments in the Boise area.

In this area the Snake River and several large tributaries converge, and are utilised to irrigate something over 600,000 acres. The area is orgasised into a number of Irrigation Districts. The farms are from 40 to 60 or 70 acres, and I was impressed with their prosperous appearance. I saw more evidence of livestock farming than in most other areas. It is a mixed farming area, with dairying, pigs and poultry. Agriculture consists of hay crops,

pasture, sugar-beet, maize, potatoes, vegetables, and a great deal of seed growing (sweet corn, vegetables and flowers). Hops are grown in some parts. The feeding of steers is a profitable industry. I saw yards where silos were filled by tip trucks asd consolidated by D/2 tractors. In the feeding yards, the troughs are filled by trucks with feeding devices on the sides. Cattle are fed hay and grain. Sugar-beet farmers have the first call on their pulp, which they use for feeding their own stock. Manure is important for beet growing. The beet crop here averages 20 tons per acre. Potatoes are a highly seasonal crop, grown to catch a particular market. I inspected a co-operative concern, where potatoes were being graded and shipped.

A common rotation is: grain plus lucerne (first year), lucerne (three years), potatoes, sugar-beet.

In many of the areas, particularly new areas, there is a saline problem, taking the form of "slick spots." These show up clearly in the crops, but appear to diminish with good farming practice in a few years. The most effective treatment is gypsum. Manure is also good, but is less permanent.

There is a general drainage problem, in the valleys and near the rivers. Open drains are used, and I saw some under construction, excavators being employed. I had a talk on drainage with the Manager of the Gem Irrigation District, who had had much experience. The depth of open drains was a minimum of 14 feet, and a maximum of 25 feet. The minimum gradient used was 1 in 500. I saw a large number of these drains, often less than half a mile apart.

Labour is an expensive item in Idaho, being about 7s. per hour, both for Mexicans and local labour.

Charges for water in the Boise area are on a "per acre" basis, and not per acre-foot. This was apparently because some land requires more water than others.

On the morning of the 29th, I called at the Soil Conservation Office in Boise, where I had a discussion and received some literature. The officers considered that our "doubtful" land should improve with irrigation, provided that over-irrigation was avoided and drainage was established. They pointed out that the salt concentration on the Sabi soils is greater at lower soil levels than at the surface, which they considered unusually favourable. They showed me the results of farming valley bottom land, which in 1925 was full of "slick spots," and which in 1932 and 1950 had greatly improved. The only treatment it had received was an application of gypsum in 1926.

In the afternoon I was taken to see the Arrowrock Dam, a 200-foot dam built in 1915.

**Salt Lake City and Logan, Utah** (30th and 31st August, 1st September). Arriving at Salt Lake City by air, I called at the Regional Office of the Bureau of Reclamation, and spent some time discussing the Sabi Project with members of the staff, who were impressed with its prospects.

I took a bus to Logan, some 60 miles north, and saw Dr. Walker, Dean of Agriculture at the Utah State College.

Later that afternoon I accompanied Dr. G. D. Clyde, who is head of the Research Branch of the Soil Conservation Service, on a tour of the irrigated areas as far as Ogden. These are some of the oldest irrigated areas in the United States, having been pioneered by the original party of Mormons, and are apparently very prosperous, the main crops grown being sugar-beet, lucerne, maize and side crops such as tomatoes.

Some areas, however, are badly water-logged, and the Weber Valley Project is being planned to drain, reclaim and supply new water for 70,000 acres now water-logged, and to supply additional water for 30,000 acres now being farmed.

On the 31st August I went over an extremely interesting experimental project at Logan, the most ambitious and complete that I had seen. The joint "project leaders" are Dr. Hansen (Soil Conservation Service), Dr. Haddock (B.P.I.S.A.E.), and Dr. Taylor (Utah State College). The experiment covers only 12 acres, but it includes a rotation trial of five crops, in four replications, with two methods of water application (surface and sprinkler), four "moisture levels," and two fertilisers combined in 32 different ways. I obtained a diagram showing the lay-out. Moisture levels are measured by tensiometers and gypsum blocks. Water applications (in surface irrigation) are measured by using horizontal pipes with small openings, the discharge of which had been calibrated. Surplus water was measured by small Parshall flumes. Field observations were noted on printed cards, which were punched, and analysed, largely by machine, in the laboratory. The whole experiment impressed one with its attention to detail and the methods used to reduce labour.

For all that, the staff employed consisted (in the field) of the three project leaders, four students (equivalent to our technical assistants), and one farm foreman, and, in the laboratory, of a full-time chemist, three part-time students, a full-time woman secretary and a part-time secretary. The services of an agricultural statistician would be required to analyse the extremely complicated results from time to time.

I had discussions with two other members of the staff, and went out with Dr. Lauritzen, of the Engineering Faculty, to see his experiments with canal linings. He had tried out various soil, stabilised soil and covered bituminous linings, but was convinced that concrete was the most satisfactory and efficient.

## PART II.

## TECHNIQUES AND CROPS.

In this section of the report I deal with specific points, at the risk of repeating some of the references in the Narrative Report.

### SECTION A.—TECHNIQUES.

1. **Soil Survey.**—I cannot over-emphasise the importance of soil survey. In the early days the Americans made tragic and costly mistakes in applying water indiscriminately to what appeared suitable land wherever it was physically possible to do so. They have learnt a costly lesson. It is now an indispensable

preliminary to any project that the soils should be completely mapped, tested and classified, all unsuitable soil being rejected.

To this end they have developed an excellent soil survey technique, which is applied and interpreted with the close co-operation of the various agencies concerned. Some details are given in the Narrative Report.

2. **Drainage.**—In irrigation projects, drains are as important as canals. The principal methods practised in the States are open drains, tile drains and "wells" (boreholes). Each method is applicable to particular conditions, and it will be a matter of experiment to determine which is the best for any given area.

The most rational attack on the drainage problem that I saw was the work in the Coachella Valley.

As a close corollary to the question of drainage there is the question of lining canals.

3. **Plant Breeding.**—Although no one specifically drew my attention to this, I could not help being struck by the amazing benefits the Americans have reaped as the result of plant breeding. One does not see straggly, uneven crops; one sees solid, uniform stands of vigorous plants, which produce extraordinarily high yields. The high quality of the food generally in the States is another testimony to plant breeding.

The breeding of resistant strains has been one of the most effective weapons against plant diseases.

4. **Fertilisers.**—With the traditional American aim of efficiency, there is great emphasis on using the maximum amount of fertiliser that will produce an economic return. I saw some amazing figures of maize yields under irrigation obtained on one of the Columbia Basin development farms. The average yield of 30 to 40 bushels (say 9 to 13 bags) had been increased to over 180 bushels (about 54 bags), by increasing the application of both nitrogen and water.

5. **Lining of Canals.**—Most of the older projects operate with unlined canals. This trend has been reversed, however, in the newer projects, as it has been realised that, apart from saving water, a lined canal reduces water-logging, drainage and salinity problems enormously, as well as maintenance costs. Many unlined canals that I saw are paralleled by a drainage ditch. It was admitted to me that many of the unlined canals would be lined if it were feasible to do so, and that the time would come when many of them would be lined, particularly in States that are short of water, such as California and Azizona.

6. **Duty of Water.**—This was a point on which I found the greatest difficulty in obtaining any accurate practical information, although I obtained literature giving experimental results. The reason for this is probably the fact that none of the Government agencies, such as the Bureau of Reclamation, deal directly with this matter. The various Irrigation District officials also were somewhat vague. Such figures as were given to me are quoted in the Narrative Report. Other information is contained in literature which I obtained.

7. **Preparation of Land.**—As pointed out earlier, great pains are taken in American projects to prepare the land correctly for irrigation. By spending time and money on the initial preparation of the land it is possible to irrigate with a minimum of labour, and this has obviously been found to pay. The degree of preparation depends on the type of land, the crops to be grown and the method of irrigation. In every case, the minor irregularities, high points and depressions, are levelled off. On "flat" land, the usual method is to lay out the fields with "borders." Certain crops, such as rice, require the most meticulous levelling, but this is done on very flat land. I saw little or no "bench terracing" on undulating land, where the usual method is the "corrugation" method (small furrows on a slight gradient), but sprinkler systems are used also to a minor extent on such land.

As an example of the cost of the preparation of land, I was told by the Bureau of Reclamation at Yuma that the Bureau charged 150 dollars (£54) per acre for clearing, levelling, ploughing, laying out for irrigation and the necessary small structures. This land was flat, and covered only with "Karroo bush" and small scrub (mesquite).

8. **Methods of Irrigation.**—As mentioned above, the commonest methods are borders or basins, and the furrow or corrugation systems. The latter, of course, are mainly applicable to row crops, but the corrugation system is often used, for example, when irrigating lucerne between borders, in order to secure better distribution and penetration of water. With the furrow and corrugation systems, there is an increasing tendency for the more progressive farmers to use "siphon tubes" to lead water to the furrows or corrugations rather than to cut the furrow banks, as is so often seen here. The tubes are 1½-inch or 2-inch diameter, about 4 feet long, curved to the proper shape, and made of aluminium, plastic or rubber, the aluminium being the best.

I also saw a considerable amount of "sub" irrigation, where water is laid on under pressure in concrete pipes. A large "riser," or vertical concrete cylinder, at the head of each field, provides local control of the head, and houses the sluice valves. Water is brought to the surface at close intervals through various types of valves, ranging from ¾-inch cocks to circular valves 8-inch to 10-inch diameter, such as the "alfalfa gate." The advantages of "sub" irrigation are saving in maintenance, saving in labour, and freedom from algae and weed growth. It is particularly suited to porous, undulating land, and is often used for citrus.

Sprinkler systems are not extensively used as yet in the West. They are mostly of the "rain-bird" type, employing aluminium pipes (6-inch stationary lines and 4-inch or 3-inch movable lines). One type I saw was supported on large wheels, the pipe forming the axis, but it seemed awkward and the jets tended to catch in the crops as they rotated.

9. **Soil Moisture Measurements.**—The "consumptive use" of water is based on these measurements, which are used in all experimental work. The determinations are made either by direct sampling and analysis, or by the use of devices for reading off the "moisture tension" and hence the moisture content.

The two pieces of apparatus used are the gypsum (plaster of paris) block and the tensiometer. I obtained literature on these devices.

Experiments on the consumptive use of water are based on maintaining the soil moistures above certain percentages of the "available moisture."

10. **Land Clearing.**—This is a simple matter in the Western States, as they have nothing more than light brush to cope with. In other parts of the U.S.A., however, there has been experience of heavy clearing, with little or no hand labour available, and it was suggested to me that the machine clearing of large trees was unduly expensive, and that they might be left, after ring-barking or burning, and removed at such times as labour was available.

11. **Economy in Labour.**—It is common knowledge, of course, that the Americans are expert at labour-saving methods, but it is very instructive to see how good organisation and mechanisation can reduce hand labour practically to zero. There is very little improvisation; machines and buildings, etc., are designed for the particular purpose for which they are used, all with the object of saving labour. There is a great tendency to leave specialised operations (e.g., baling lucerne, spraying crops and tile draining) to specialist contractors. Farmers are, however, mostly equipped with the implements they actually use, and frequently spend more on implements than on the farm itself. In such circumstances a farmer can carry out practically all his farming operations single-handed, so much so that agricultural advisers often complained that they found it difficult to persuade the farmer to leave his tractor-seat to do anything else!

12. **Canal Seepage Losses.**—I came across two interesting pieces of experimentation. One was by Dr. Rohwer, of the Soil Conservation Service, who was measuring the penetration of water into soils with an apparatus consisting of two concentric rings, 6 and 18 feet diameter, kept full of water to a uniform depth. His work has not yet been published.

I also saw a very interesting apparatus developed at Logan and Riverside for measuring the penetration of water through a small area in the side or bottom of a canal actually in service. I obtained literature on this work.

13. **Use of Aeroplanes.**—Aeroplanes are being increasingly used for such operations as spraying or dusting crops, seeding and fertilising lands. The planes were of the light, slow biplane type. Helicopters, which are more expensive, are used to a lesser extent.

14. **House Coolers.**—I have referred elsewhere to the simple device used for cooling houses and other buildings in the hottest part of the States. Without it, the living conditions in the summer would hardly be tolerable. It is such a simple and cheap attachment, compared with the cost of a house, that I consider that it would be well worth while using it on all houses put up in the Sabi Valley, and for that matter in any other hot, dry parts of the country. The only supplies required are water and electric power. The apparatus is simple and could readily be manufactured in the Colony.

## SECTION B.—CROPS.

15. **Lucerne.**—This is the universal crop and the foundation of every irrigation project. It is grown in all climates, from the coldest northern States, which have a short growing season but long summer days, to the hottest desert regions of the south-west. It is the universal soil-builder, and scientists admitted to me that lucerne produced benefits for which their present knowledge could not fully account. For this reason it is an essential item in any rotation.

It is most commonly sold or consumed as hay, and the amount of hay that is stored for the winter would be an object lesson to many Rhodesian farmers. It is also sold to de-hydration concerns, for poultry and dairy feed. To some extent it is grazed in the field, by sheep or dairy stock, but grazing must be moderate to avoid crop damage, and there is a danger of "bloat."

It is usually grown for three or four years, but sometimes as long as six years. In the colder climates only three cuttings are taken each year, but in the south as many as seven. It is often seeded with a grain crop such as wheat or oats.

The water requirement was stated to be 3½ to 4 acre-feet in a 12-month season. Put in another way, each ton of cured hay requires at least 750 tons of water, or about seven inches of water per acre (including "useful rainfall").

The varieties used in the South-West were stated to be those known as Chilean, Indian, African and the Hairy Peruvian.

In parts of the South-West the growing of seed, for sale locally or for the Northern market, is a profitable undertaking.

There is no doubt in my mind from what I saw that the growing of large acreages of lucerne in the Sabi Valley could revolutionise the cattle ranching industry in the Low Veld, not only by increasing the yield and quality of beef obtainable from existing herds, but by making it possible to utilise better breeds than is the case at present. Dairying and sheep raising would benefit in much the same way.

16. **Maize.**—This is one of the main crops grown under irrigation in the Western States. Thanks to the introduction of suitable hybrids, and to the relatively heavy but economic use of fertilisers, and good farming practices, heavy yields are obtained. All the maize I saw was closely planted, three feet between rows and 9 inches to 12 inches in the row. Close planting gave a clean crop and better yields.

17. **Barley.**—This is extensively grown in the Western States, to the virtual exclusion of oats. In some places it was grown with as little as 12 inches of water. Most of the barley I saw was grown for malting purposes.

18. **Sorghums.**—This is an irrigated crop which has made great progress through successful plant breeding. A double-dwarf variety that I saw grows to a height of only about three feet, and carries a phenomenal crop of heads. It is suitable for "combining." Sorghum yields average about 40 bushels but go

as high as 120 bushels, and generally are higher than maize. This is a crop which should be of great value under Rhodesian conditions. Water requirements are given as about 18 inches.

19. **Cotton.**—This is, of course, confined to the hotter regions in the South, and is one of the biggest money-makers at present. The water requirement was given as 2½ to 3 acre-feet per acre. Yields vary from about 1,000 lbs. to as high as 2,000 lbs. of lint per acre.

The growing is highly mechanised, and cotton-picking machines are being increasingly used. To facilitate machine-picking, aeroplanes are used to apply a "de-foliant" to the plants when the crop is mature, causing the leaves to fall off, and leaving nothing but bare stems and bolls for the machine to operate on. Insecticides are also applied by aeroplane.

The suggestion in the Alexander Gibb Report that cotton should be tried as a winter crop in the Sabi Valley, in order to avoid stainer beetle attacks, was not supported in the States, as it was considered that the winter temperatures were too low to produce an economic crop or any crop at all.

One of the interesting machines I saw was a "tractor on stilts," high enough to clear a crop four to five feet tall; at Shafter it was used to pull a high-mounted trailer for spraying cotton. All wheels were fitted with curved guards to prevent damage to the crop.

20. **Wheat.**—This is an important crop for the Sabi Valley, but as it is not grown under irrigation in the States I was not able to obtain much useful information.

In discussing wheat with Dr. Bayles at Beltsville, however, he suggested that there were certain rust-resistant wheats that might be tried here as summer crops, such as "Baart 38," "White Federation 38," and "Coastal." He also mentioned that the Mexican variety "Supremo" could be grown in either winter or summer.

21. **Rice.**—This is a crop of particular importance to the Sabi Valley, but is not grown to any extent in the U.S.A., except in parts of California, and particularly the Sacramento Valley.

As rice is grown in flooded fields, it requires an impervious sub-soil. The water requirement was stated to be four to six acre-feet per acre. Yields average about 2,000 lbs. per acre, but in some parts they go up to 3,500 lbs. In California the Japanese type is grown.

Very accurate levelling of the land is required, but hand labour is reduced to a minimum.

Rice has an important use in reclaiming saline soils, and has been used for this purpose in the Imperial Valley. I obtained notes from a paper written on this aspect.

It was stressed that if reaping is to be done mechanically, there must be a means of draining and drying out the land when required. Further, that it is often necessary to be able to dry the grain artificially, as it is harvested at 25 per cent. moisture.

I was not able, however, to follow this up when I reached the rice-growing areas.

Rice often follows a legume, which should receive a phosphatic fertiliser. The rice should not in that case need nitrogenous fertilisers, but may require more phosphates. A common rotation in California is rice, beans, wheat, beans, and then back to rice.

I gained the impression that rice-culture has an adverse effect in puddling the soil, and that we should experiment in the basaltic area of the Sabi, for instance, to endeavour to find a suitable rotation of other crops as an alternative to rice.

22. **Pasture Grasses.**—In most of the mixed farming areas irrigated pastures play an important part. In the Boise area, for instance, as much as 18 per cent. of the land was in pasture crops. Much of this is clover, and mixed pasture.

I had useful discussions at Beltsville with Dr. Myers and Mr. M. A. Hein. In connection with mixing grasses with lucerne, in order to avoid the danger of "bloat" in cattle and sheep, Dr. Myers suggested that we might try Rhodes Grass, Dallas, *Phalaris tuberosa*, *Paspalum* and *Bromus catharticum*. He saw no reason why some of their clovers should not be successful here, under irrigation. Mr. Hein suggested other grasses: *Erogrostis chloromelas*, *Erogrostis lehmanniana*, *Festuca arundinaceae* (tall fescue). The latter, he thought, would stand a great deal of heat. Dallas he thought suitable for heavy soils, and Rhodes Grass for lighter soils. He considered that *Andropogon ischaemum* and *A. intermedius* (blue stem) would get along with limited amounts of water, and would be worth trying with lucerne. Most of the above-named are perennial. He suggested checking on "wheat grasses" (*Agropyron elongatum*) at tht Nurseries at Tucson, but unfortunately I had no chance of doing so.

I have discussed the above grasses with the Chief Pasture Research Officer since my return, and find that he already has a number of them under trial.

23. **Feeding, Livestock and Dairying.**—I can hardly overstress the importance of this subject, as affecting the Sabi Scheme, but since I have already made detailed references to it elsewher in this report, I will merely mention it again here.

24. **Citrus.**—Since the Sabi Scheme is primarily intended to produce the staple foods of which Rhodesia is short, I was inclined to treat citrus as something of a side-line, but I saw enough of citrus growing in the States to realise what a valuable side-line it would be to farmers in the Sabi Valley, where the conditions would appear to be nearly ideal.

Admittedly, it is mainly grown in the southern coastal belt of California, but with only about nine or ten inches of (winter) rainfall (plus irrigation), and I saw a great deal on the Yuma Mesa, where the heat is intense and the rainfall only three inches. The Mesa with its deep porous sandy soil suited citrus better than the heavier soils of the Yuma Valley, but it is possible that

similar conditions could be found in the Sabi, if the alluvial soils did not prove suitable.

Owing to the increasing use of concentrates, the citrus growers in the U.S.A. market only the best of their crop as fresh fruit. The principal citrus fruits grown are, I was informed, Marsh's Seedless Grapefruit, Eureka (preferred) and Lisbon Lemons, and Valencia (preferred) and Washington Navel Oranges. Other fruits grown in the same areas are Tangerines and Avocado Pears.

Even in Southern California the winters are severe enough to necessitate the use of "smudge" stoves (oil burning) in the groves to raise the temperature. This smoke causes a nuisance in the neighbouring towns, and gives rise to what is known as "smog" (smoke plus fog).

25. **Dates.**—I have already referred to this valuable fruit, and would here merely suggest that dates would be worth trying in the Sabi Valley, particularly in the Native Areas, where a native family could provide its own labour for the various hand operations.

The chief point of doubt is whether the date crop would be damaged by rains in the latter part of the rainy season, since dates are grown in virtually rainless parts of Arizona and California. However, the heavy paper inverted cones used there to protect the bunches of dates might be adequate.

26. **Sugar Cane.**—My report on this point is completely negative, as there is virtually no sugar cane grown in the States, and none at all under irrigation. I obtained, however, a useful paper relating to sugar cane growing in Hawaii.

# Preliminary Report on a Comparison of Several Heavy Yielding Perennial Grasses for the Production of Ensilage

By T. C. D. KENNAN, Pasture Research Officer,
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## I. INTRODUCTION.

In semi-arid countries the protection of arable land from wind erosion should be a major consideration in any agricultural system. In some areas systems of annual cropping can quickly lead to dust bowl conditions, which result in reduced production or eventual abandonment. In many parts of Matabeleland the success of an annual crop often depends on planting coinciding with the first rains. This necessitates winter ploughing, which leaves the land in a condition most susceptible to wind erosion. A perennial crop not only obviates this danger, but if the crop be fairly close growing, the losses of soil by water erosion can be very substantially, if not completely, reduced.

Perennial grasses, besides being particularly valuable in reducing wind and water erosion to a minimum, have the ability of restoring and maintaining structure in the soil (1). All farmers recognise the value of soil crumb structure, but practically all have their quota of poor, structureless lands. Perennial grasses, with their well developed root systems, are particularly well adapted for restoring the structure and are commonly used in leys in older established farming communities.

Their productivity under adverse conditions is another very good reason for the incorporation of perennial grasses in the cropping rotation. Perennial grasses have the ability of ceasing to grow during dry spells and of continuing again when conditions are more favourable. Most annual crops, on the other hand, are stunted by droughty periods and give very much reduced yields as a result.

Work on planted pastures was started on the Central Veld and Pasture Station for Matabeleland towards the end of 1945. Much of this work has, of course, been developmental and until the beginning of the 1948-49 growing season bulking up and preliminary selection of grasses and other pasture plants were the primary considerations.

With the need for perennial crops in mind, and with a view to testing, over a period of years, the yields of seven heavy yielding perennial grasses and comparing them with those of three of the more common annual ensilage crops of Matabeleland, an experiment was laid down at the end of 1948.

The original and main purpose of the trial was to compare over a period of years and at three different espacements, the productivity of seven varieties of perennial grasses, which had been selected previously in preliminary trials as being suitable for the production of ensilage under dry land conditions at Matopos. In order to round off the trial and to provide a comparison between the yields obtained from these perennial grasses and the standard Matabeleland ensilage crops, it was decided to include as varieties in the yield trial maize, sorghum and nyouti (*Pennisetum typhoideum*, also known as Munga and Babala).

[The varieties of and the espacement at which these annual crops are grown, are those recommended for the purpose of this experiment by Mr. T. K. Sansom, the Senior Field Husbandry Officer.]

## II. MANAGEMENT AND METHODS.

Productivity is assessed by dry herbage yields and by the chemical composition of the crops at the time of cutting. In this paper conclusions are based on the dry herbage yields for the seasons 1948-49 and 1949-50 and on the chemical analysis data for the 1948 season.

### 1. DESIGN OF THE EXPERIMENT.

The experimental area occupies about 1½ acres of typical red basement schist soil which had been annually cropped for a considerable period prior to the commencement of the experiment. The soil was in very poor physical condition and a good deal of surface erosion had taken place. A comparatively even slope of approximately 3-4 per cent. runs from north to south over the entire area.

Twenty-four varieties are replicated five times in randomised blocks. Plots are 18 feet square and are separated from each other by 6-foot strips which have been built up in the form of banks to prevent the loss of rain water by run-off.

Varieties are as follows:—

1.—Gold Coast Elephant Grass, *Pennisetum purpureum*, at 3′ x 3′ esp.
2.—Gold Coast Elephant Grass, *pennisetum purpureum*, at 3′ x 6′ esp.
3.—Gold Coast Elephant Grass, *Pennisetum purpureum*, at 6′ x 6′ esp.
4.—Cameroons Elephant Grass, *Pennisetum purpureum*, at 3′ x 3′ esp.
5.—Cameroons Elephant Grass, *Pennisetum purpureum*, at 3′ x 6′ esp.
6.—Cameroons Elephant Grass, *Pennisetum purpureum*, at 6′ x 6′ esp.
7.—R.M.E. Napier, *Pennisetum purpureum* ..... at 3′ x 3′ esp.
8.—R.M.E. Napier, *Pennisetum purpureum* ..... at 3′ x 6′ esp.
9.—R.M.E. Napier, *Pennisetum purpureum* ..... at 6′ x 6′ esp.
10.—Kazungula Setaria, P.1192, *Setaria spacelata* ..... at 3′ x 3′ esp.
11.—Kazungula Setaria, P.1192, *Setaria spacelata* ..... at 3′ x 6′ esp.
12.—Kazungula Setaria, P.1192, *Setaria spacelata* ..... at 6′ x 6′ esp.
13.—Kazungula Setaria, P.1193, *Setaria spacelata* ..... at 3′ x 3′ esp.
14.—Kazungula Setaria, P.1193, *Setaria spacelata* ..... at 3′ x 6′ esp.

15.—Kazungula Setaria, P.1193, *Setaria spacelata* ..... at 6′ x 6′ esp.
16.—*Echinochloa pyramidalis* (Limpopo) ..... at 3′ x 3′ esp.
17.—*Echinochloa pyramidalis* (Limpopo) ..... at 3′ x 6′ esp.
18.—*Echinochloa pyramidalis* (Limpopo) ..... at 6′ x 6′ esp.
19.—Guinea Grass, *Panicum maximum* ..... at 3′ x 3′ esp.
20.—Guinea Grass, *Panicum maximum* ..... at 3′ x 6′ esp.
21.—Guinea Grass, *Panicum maximum* ..... at 6′ x 6′ esp.
22.—Maize (Golden Beauty) ..... at 12″x 24″esp.
23.—Sorghum (Strain W.S./B.G. ex A.E.S.) ..... at 12″x 18″esp.
24.—Nyouti, *Pennisetum typhoideum* (Strain 51/47 ex A.E.S. ..... at 12″x 18″esp.

**N.B.**—The original stocks of all the perennial grasses, except the R.M.E. Napier and the Guinea Grass, were obtained from the Prinshoff Grass Breeding Station, Pretoria. The Guinea Grass was supplied by the Salisbury Experimental Station and the R.M.E. Napier is a strain that has grown on Rhodes Matopo Estate for many years.

During the 1948 season fertiliser was applied to all plots at the following rate:—

200 lbs. superphosphate
100 lbs. nitrate of soda } per acre.
50 lbs. muriate of potash

It was decided, however, that this dressing was too low, and for the 1949-50 season requirements of Nitrogen and Phosphate were calculated on the basis of an estimated yield of four tons dry matter per acre. This was as follows:—

600 lbs. nitrate of soda } per acre.
200 lbs. superphosphate

The nitrate of soda was applied in three equal dressings during the season. A dressing of two tons agricultural lime per acre was given at the beginning of the season just prior to the application of superphosphate and the first dressing of nitrate of soda.

In yielding the perennial grasses the outside rows were discarded. In the case of the annuals a 3-feet border round each plot was discounted. All plots were cut at the same time, which means that some varieties had passed their optimum stage for ensilage. In future a new procedure will be adopted in which each variety will be cut at its optimum stage.

## 2. YIELDING TECHNIQUE.

As each plot was cut the total herbage was weighed and then chaffed in a silage cutter. Two large samples were then taken. From one of these, sub-samples were taken for immediate water determinations. In 1949 the other was put aside until all replicates of each treatment had been cut, when the five samples were bulked and thoroughly mixed. Sub-samples were taken from the

resultant mixture. These were dried at a temperature of between 80° and 90° C. before being sent to Salisbury for chemical analysis. In 1950 it was found necessary to reduce the number of samples, and as a result all samples from each variety were bulked.

### 3. STATISTICAL TECHNIQUE.

The dry matter yields have been analysed statistically for the two seasons individually and also for the two seasons combined. In the individual analyses the variance of the interaction varieties x replicates was taken as the error variance. In the analysis of the data for the combined seasons the bulked variance of the interactions variety x replicate x season, season x replicate and variety x replicate was taken as the error variance.

Chemical analysis data are only available as yet for the 1948-49 season. These have not been analysed statistically (2, 3, 4).

## III. SEASONAL CONDITIONS.

Rainfall is undoubtedly the most important factor affecting seasonal fluctuations in yield. At Matopos the dry season is long and, although good rains maye be expected between November and March, it very rarely occurs that more than two of these months produce satisfactory rains. The average monthly rainfall for the period 1922-46 is given in Table I. Also shown are the figures for 1948-49 and 1949-50.

TABLE I.

**Average Monthly Rainfall (1922-1946) and Monthly Falls for the Seasons 1948-49 and 1949-50.**

| Season | Average 1922-46 | 1948-49 | 1949-50 |
|---|---|---|---|
| July | Trace | 0.00 | 0.00 |
| August | Trace | 0.00 | 0.00 |
| September | 0.16 | Trace | 0.00 |
| October | 0.94 | 1.26 | 0.21 |
| November | 3.25 | 3.73 | 2.68 |
| December | 4.62 | 2.60 | 7.47 |
| January | 5.12 | 9.87 | 0.83 |
| February | 4.52 | 2.93 | 3.88 |
| March | 3.82 | 2.46 | 0.54 |
| April | 0.70 | 0.13 | 0.88 |
| May | Trace | Trace | 0.07 |
| June | Trace | 0.12 | 0.00 |

The experiment was planted at the end of November, 1948, but did not get away to a good start as the December rainfall was low. A few plants which did not take had to be replaced

during January and February. Trouble from rats was experienced with the establishment of the annuals and several replantings to fill the gaps were necessary. Good rains fell during January and all plots were well established by the end of the season. Yields for the season were rather low, but were reasonable considering the low rainfall just after planting and that it was the year of establishment.

The 1949-50 season also produced low yields. During this season good rains fell at the end of November and during December, but after that no effective rain fell until the end of February, when over two inches were recorded in one storm. March was dry.

## IV. PHENOLOGY.

Regular phenological observations have been made since the commencement of the experiment. A brief summary of these notes is given hereunder:—

### 1. 1948-49.

For the first month after planting, all plants suffered to a certain extent from drought and, as stated above, a few had to be replaced during January and February. In Table II the percentage replacements for each grass variety are shown.

TABLE II.

| Grass | Replacements 18.1.49 | Replacements 9.2.48 | Total Replacements |
|---|---|---|---|
| Gold Coast Elephant Grass ..... | 4.09% | 0.22% | 4.31% |
| Cameroons Elephant Grass ..... | 5.16% | Nil | 5.16% |
| R.M.E. Napier ..... ..... ..... ..... ..... ..... | 1.15% | Nil | 2.15% |
| Kazungula Setaria, P.1192..... ..... | 2.58% | 0.22% | 2.80% |
| Kazungula Setaria, P.1193..... ..... | 1.51% | Nil | 1.51% |
| *Echinochloa pyramidalis* ..... ..... | 2.15% | 0.22% | 2.37% |
| Guinea Grass ..... ..... ..... ..... ..... ..... | 8.17% | 4.73% | 12.90% |

**NOTE.**—The fact that a very high percentage of the Guinea Grass plants died and had to be replaced is largely because the available planting material was very immature. No record was kept of the number of seeds of the annuals that had to be replaced, but this was very high. Most losses were caused shortly after germination by rats.

By the middle of February all plants were well established and no difference could be seen between wide and close spacings. At this stage the Echinochloa was doing best, having attained a height of 4-5 feet. The West African Elephant Grasses were doing well and stood about 4-feet high. The Gold Coast strain was slightly uneven and not quite as leafy as the Cameroons. Of the Kazungula Setarias the P.1192 strain was temporarily wilted and had produced very few culms, while the P.1193 strain was flower-

ing profusely at a height of 4-5 feet. The R.M.E. Napier had grown well, but had very little leaf, and the Guinea Grass, while well stooled, had very little upright growth. The maize was doing well and tasselling at a height of about 6-feet, and the Sorghum was very even, having attained a height of about 3-feet. The Nyouti at 4-6-feet was rather uneven and stooling was poor.

The plots were cut between 29.3.49 and 23.4.49 by which time all plants were mature. The only treatment that yielded really well was the Sorghum. The maize was poor and rather drought stricken, as also was the R.M.E. Napier. The West African Elephant Grasses and the Echinochloa were fairly good, but were beginning to lose some basal leaves. The two Kazungula Setarias were fair, but the P.1192 strain was rather wilted and had lost some leaf. The Guinea Grass was quite good, although short.

After cutting, the plots that had contained annuals were dug over while the grasses put on a little fresh growth. This was killed by frost in June.

2. 1949-50.

By the end of September, 1949, the Elephant Grasses, the Napier and the Echinochloa were growing fairly actively and were being grazed by hares and small buck. The other grasses were still dormant. At this stage it was decided to replace small plants so as to obtain even stands. In order that the replacements should be well established before general growth took place they were watered. This was carried out by using basins so as to cause as little stimulation to surrounding plants as possible. About twice as many Cameroons and Guinea Grass plants had to be replaced as any of the others. For all varieties 7.8% of the 3-ft. x 3-ft. plots, 4.7% of the 3-ft. x 6-ft. plots and 2.3% of the 6-ft. x 6-ft. plots had to be replaced.

The annuals were planted on the 5th December and good rains ensured satisfactory germination. A few replacements had to be made on December 19th to fill gaps made by rats.

By 10.1.1950 all plots were growing well, although some were slightly uneven. The Echinochloa had grown out best, but the West African Elephant Grasses and Kazungula Setaria P.1193 were also doing well. In the Gold Coast, however a border effect was rather noticeable. The R.M.E. Napier, Kazungula Setaria P.1192 and Guinea Grass, although doing well, were somewhat slow. The three annuals were growing very well.

After practically no rain in January, all the plots showed signs of wilting by 9.2.1950. The Maize, Kazungula Setaria P.1192 and the Guinea Grass were the most severely affected, whilst the Sorghum, Nyouti and Kazungula Setaria P.1193 were only slightly better. The Elephant Grasses, Napier and particularly the Echinochloa were losing some basal leaves and the leaf tips were drying off.

The plots were cut between the 16th and 28th March, by which time some were showing definite signs of drying off. The Maize was the worst, followed by Echinochloa, Sorghum, Nyouti and Kazungula Setaria P.1192. The West African Elephant Grasses had lost more leaf, but were standing up well, as was the Kazungula Setaria P.1193. The R.M.E. Napier and the Guinea Grass were badly wilted and some leaves had dried off.

After cutting, the annual plots were again dug over and the perennials put on a little more leaf. This was frosted back on 23.5.1950.

## V. YIELD RESULTS AND DISCUSSION.

In Table III are shown the average yields of green material and oven-dry material in tons per acre for seasons 1948-49 and 1949-50 as well as for the combination of the two seasons. It will be noted that the yields throughout were low. This was partly due to the unsatisfactory rainfall, but was chiefly because of the poor condition of the soil. As stated above, the experiment is sited on very poor, shallow soil, which had been deemed since the 1946-47 season to be too worn out for crop production. On the whole, however, considering the erratic nature of the rainfall and the poor condition of the soil, yields were considered to be fairly satisfactory.

TABLE III.

**Average Green and Dry Matter Yields in Tons per Acre.**

| | | Average Yield in Tons per Acre | | | | | |
|---|---|---|---|---|---|---|---|
| | | Green Weight | | | Dry Weight | | |
| Variety | | 48-49 | 49-50 | Average | 48-49 | 49-50 | Average |
| Sorghum | — | 9.43 | 4.79 | 7.11 | 3.04 | 1.37 | 2.20 |
| Cam. Elephant Grass | 3′ x 3′ | 7.44 | 8.19 | 7.82 | 1.97 | 2.35 | 2.16 |
| G.C. Elephant Grass | 3′ x 3′ | 7.43 | 8.40 | 7.92 | 1.92 | 2.25 | 2.09 |
| Echinochloa | 3′ x 3′ | 5.28 | 5.60 | 5.44 | 1.38 | 2.50 | 1.94 |
| Kaz. Setaria, P.1193 | 3′ x 3′ | 6.27 | 5.19 | 5.73 | 1.99 | 1.85 | 1.92 |
| G.C. Elephant Grass | 3′ x 6′ | 7.14 | 7.12 | 7.13 | 1.81 | 2.01 | 1.91 |
| Nyouti | — | 9.25 | 4.17 | 6.71 | 2.39 | 1.26 | 1.83 |
| Kaz. Setaria, P.1193 | 3′ x 6′ | 5.81 | 5.83 | 5.82 | 1.65 | 1.89 | 1.77 |
| Guinea Grass | 3′ x 3′ | 4.45 | 4.69 | 4.57 | 1.49 | 2.02 | 1.76 |
| Echinochloa | 3′ x 6′ | 4.06 | 5.98 | 5.02 | 1.16 | 2.20 | 1.68 |
| Cam. Elephant Grass | 3′ x 6′ | 5.01 | 7.12 | 6.07 | 1.27 | 2.03 | 1.65 |
| Kaz. Setaria, P.1192 | 3′ x 3′ | 5.93 | 4.96 | 5.45 | 1.65 | 1.59 | 1.62 |
| G.C. Elephant Grass | 6′ x 6′ | 5.28 | 6.47 | 5.88 | 1.32 | 1.81 | 1.57 |
| Cam. Elephant Grass | 6′ x 6′ | 5.32 | 6.38 | 5.85 | 1.32 | 1.82 | 1.57 |
| Guinea Grass | 3′ x 6′ | 3.14 | 3.85 | 3.50 | 1.37 | 1.76 | 1.57 |
| Maize | — | 7.61 | 4.47 | 6.04 | 1.69 | 1.43 | 1.56 |
| R.M.E. Napier | 3′ x 3′ | 4.53 | 5.54 | 5.04 | 1.24 | 1.51 | 1.37 |
| Kaz. Setaria, P.1192 | 3′ x 6′ | 5.33 | 4.79 | 5.06 | 1.27 | 1.43 | 1.35 |
| Echinochloa | 6′ x 6′ | 2.98 | 5.02 | 4.00 | 0.78 | 1.83 | 1.30 |
| R.M.E. Napier | 3′ x 6′ | 4.48 | 4,82 | 4.65 | 1.01 | 1.33 | 1.17 |
| Guinea Grass | 6′ x 6′ | 2.48 | 3.87 | 2.68 | 0.82 | 1.53 | 1.17 |
| Kaz. Setaria, P.1193 | 6′ x 6′ | 4.02 | 4.09 | 4.06 | 1.06 | 1.26 | 1.16 |
| R.M.E. Napier | 6′ x 6′ | 4.08 | 4.03 | 4.06 | 0.87 | 1.11 | 0.99 |
| Kaz. Setaria, P.1192 | 6′ x 6′ | 3.02 | 3.63 | 3.33 | 0.65 | 1.08 | 0.87 |

At P = 0.05 the Minimum Differences Significant (M.D.S.) are as follows for the oven-dry data:—

| | M.D.S. Treatments | M.D.S. Spacings |
|---|---|---|
| 1948-49 Season | 0.63 tons | 0.24 tons |
| 1949-50 Season | 0.41 tons | 0.16 tons |
| Both Seasons | 0.37 tons | 0.14 tons |

In Tables IV and V the average dry matter yields for all plots of each variety are shown. In the case of the perennials (Table IV), the yields of all replicates and all treatments for each variety have been bulked and averaged.

TABLE IV.

**Average Yields of Perennials (Dry Matter in Tons per Acre).**

| Variety | 1948-49 | 1949-50 | Average |
|---|---|---|---|
| Gold Coast Elephant Grass | 1.68 | 2.02 | 1.86 |
| Cameroons Elephant Grass | 1.52 | 2.07 | 1.79 |
| Kazungula Setaria, P.1193 | 1.57 | 1.67 | 1.62 |
| *Echinochloa pyramidalis* | 1.11 | 2.18 | 1.58 |
| Guinea Grass | 1.23 | 1.77 | 1.50 |
| Kazungula Setaria, P.1192 | 1.19 | 1.37 | 1.45 |
| R.M.E. Napier | 1.31 | 1.32 | 1.18 |

At P = 0.05 the Minimum Differences Significant are:—

1948-49 Season 0.36 tons
1949-50 Season 0.24 tons
Both Seasons 0.21 tons

TABLE V.

**Average Yields of Annuals (Dry Matter in Tons per Acre).**

| Variety | 1948-49 | 1949-50 | Average |
|---|---|---|---|
| Sorghum | 3.04 | 1.37 | 2.20 |
| Nyouti | 2.39 | 1.26 | 1.83 |
| Maize | 1.69 | 1.43 | 1.56 |

At P = 0.05 the Minimum Differences Significant are:—

1948-49 Season 0.63 tons
1949-50 Season 0.41 tons
Both Seasons 0.37 tons

In Table VI the chemical analysis data, as well as the Crude Protein in pounds per acre for the season 1948-49 are shown. The data for the season 1949-50 are not yet available.

TABLE VI.

**Chemical Composition of Herbage and the Yield of Crude Protein in Pounds per Acre for the Season 1948-49. Percentage Expressed in Terms of Oven-Dry Material.**

| Herbage | | % Total Ash | % Acid Sol. Ash | % P205 | % CaO | % Crude Protein | Crude Protein Lbs/Acre |
|---|---|---|---|---|---|---|---|
| Nyouti | — | 9.63 | 5.26 | 0.28 | 0.64 | 8.17 | 390.5 |
| Sorghum | — | 7.54 | 3.38 | 0.18 | 0.49 | 5.46 | 332.0 |
| Cam. Elephant Grass | 3′ x 6′ | 10.77 | 7.83 | 0.25 | 0.28 | 9.63 | 244.6 |
| Cam. Elephant Grass | 3′ x 3′ | 10.28 | 6.43 | 0.22 | 0.26 | 6.11 | 240.7 |
| G.C. Elephant Grass | 3′ x 6′ | 10.80 | 5.53 | 0.20 | 0.42 | 6.60 | 238.9 |
| Cam. Elephant Grass | 6′ x 6′ | 10.46 | 6.53 | 0.19 | 0.31 | 8.77 | 231.5 |
| Guinea Grass | 3′ x 6′ | 11.42 | 8.11 | 0.19 | 0.63 | 8.44 | 231.3 |
| Kaz. Setaria, P.1192 | 3′ x 3′ | 10.45 | 6.31 | 0.21 | 0.51 | 7.21 | 227.9 |
| Maize | — | 9.15 | 4.48 | 0.23 | 0.59 | 6.57 | 222.1 |
| Guinea Grass | 3′ x 3′ | 10.71 | 7.55 | 0.17 | 0.64 | 7.25 | 216.1 |
| G.C. Elephant Grass | 3′ x 3′ | 10.00 | 4.95 | 0.17 | 0.34 | 5.48 | 210.4 |
| Kaz. Sectaria, P.1193 | 3′ x 6′ | 7.80 | 5.93 | 0.17 | 0.35 | 6.34 | 209.2 |
| Kaz. Setaria, P.1192 | 3′ x 6′ | 9.51 | 5.95 | 0.24 | 0.54 | 8.22 | 208.8 |
| G.C. Elephant Grass | 6′ x 6′ | 10.00 | 6.31 | 0.24 | 0.37 | 7.78 | 205.4 |
| Kaz. Setaria, P.1193 | 3′ x 3′ | 7.00 | 5.74 | 0.15 | 0.28 | 4.78 | 190.2 |
| R.M.E. Napier | 3′ x 6′ | 10.72 | 7.06 | 0.23 | 0.44 | 8.45 | 170.7 |
| Kaz. Setaria, P.1193 | 6′ x 6′ | 7.51 | 6.25 | 0.20 | 0.28 | 7.45 | 157.9 |
| R.M.E. Napier | 6′ x 6′ | 10.18 | 7.23 | 0.22 | 0.35 | 8.93 | 155.4 |
| R.M.E. Napier | 3′ x 3′ | 10.22 | 6.61 | 0.28 | 0.34 | 6.24 | 154.8 |
| Guinea Grass | 6′ x 6′ | 11.66 | 8.25 | 0.17 | 0.57 | 8.54 | 140.1 |
| Kaz. Setaria, P.1192 | 6′ x 6′ | 9.22 | 7.06 | 0.23 | 0.33 | 9.12 | 118.6 |
| Echinochloa | 3′ x 6′ | 10.22 | 5.76 | 0.11 | 0.68 | 4.80 | 111.4 |
| Echinochloa | 3′ x 3′ | 9.60 | 5.45 | 0.15 | 0.67 | 3.94 | 108.7 |
| Echinochloa | 6′ x 6′ | 10.67 | 5.91 | 0.14 | 0.71 | 5.37 | 83.8 |

Footnote.—The above tables are interesting. All yields have been low, but it is considered that this is largely due to the fact that the soil is both shallow and very poor. Had the experiment been laid out on more fertile soil, the yields would undoubtedly have been very much higher.

(Footnote continued on next page)

In the experiment under review, judging varieties as a whole, in the first season the Sorghum gave significantly higher yields than any of the other crops, while the Nyouti out-yielded all treatments except Gold Coast Elephant Grass at spacings of 3-feet x 3-feet and 3-feet x 6-feet, the Sorghum and the Cameroons Elephant Grass and Kazungula Setaria, P.1193, both at spacings of 3-feet x 3-feet. Maize was out-yielded by the Sorghum and Nyouti, but gave more than the R.M.E. Napier, both Kazungula Setarias, the Echinochloa and the Guinea Grass (all at 6-feet x 6-feet), as well as R.M.E. Napier at 3-feet x 6-feet.

Of the grasses, the Gold Coast Elephant Grass at 3-feet x 3-feet produced more than the Cameroons strain at 3-feet x 6-feet, the R.M.E. Napier at all spacings, the Echinochloa and Kazungula Setaria, P.1192, both at 3-feet x 6-feet and 6-feet x 6-feet spacings and the Kazungula Setaria, P.1193, and Guinea Grass at 6-feet x 6-feet spacings.

The yields of the Cameroons Elephant Grass and the Kazungula Setaria, P.1193, at 3-feet x 3-feet were about the same, but both produced more than the Cameroons Elephant Grass at 6-feet x 6-feet, while the latter also out-yielded Gold Coast Elephant Grass at 6-feet x 6-feet. The yields of the R.M.E. Napier, the Echinochloa, the Kazungula Setaria, P.1192, and the Guinea Grass were low.

Fairly low yields are to be expected from the perennial crops during the year of establishment and the 1949-50 season showed up considerable differences in the order of yields.

In this season the Sorghum and Nyouti were out-yielded by the two West African Elephant Grasses and the Echinochloa at all spacings, the Kazungula Setaria, P.1193, at 3-feet x 3-feet and 6-feet x 6-feet, and the Guinea Grass at 3-feet x 3-feet. The Guinea Grass at 3-feet x 6-feet did better than Nyouti. Maize also produced a small crop which was not significantly greater than those of Nyouti or Sorghum.

Table VII shows yields obtained from some of the perennial grasses (all planted at 3-feet x 3-feet spacings) in the year of establishment on good, fertile soil.

TABLE VII.

**Yield of Crude Protein and Green Material of Five Heavy Yielding Perennial Grasses (Season 1947-1948).**

| *Grass* | Yield per Acre Pounds Crude Protein | Tons Green Material |
|---|---|---|
| Gold Coast Elephant Grass ..... ..... ..... | 1193.9 | 30.03 |
| Cameroons Elephant Grass ..... ..... ..... | 1553.6 | 31.85 |
| Kazungula Setaria, P.1192 ..... ..... ..... ..... | 545.2 | 18.08 |
| Kazungula Setaria, P.1193 ..... ..... ..... ..... | 724.2 | 23.91 |
| *Echinochloa pyramidalis* (Limpopo) | 567.0 | 18.75 |

The yields of Gold Coast Elephant Grass, Cameroons Elephant Grass and the Echinochloa were better than those of any other crops. The Kazungula Setaria, P.1193, and the Guinea Grass also did well, but R.M.E. Napier and the Kazungula Setaria, P.1192, were again low and were grouped with the Maize, Sorghum and Nyouti.

The average yields for the two seasons raise the Sorghum and Nyouti considerably, and in this case they are grouped with the best grasses. These are Gold Coast Elephant Grass at 3-feet x 3-feet and 3-feet x 6-feet, Cameroons Elephant Grass, the Kazungula Setaria, P.1193, and the Echinochloa at 3-feet x 3-feet. Over the two years, however, the Sorghum gave a higher average yield than the Nyonti. The average Maize yield is well below those of the better grasses.

Results to date show that while the annual crops did better during the first year than the perennial grasses, the latter are now coming into their own and may very well do better in the future. All yields so far have been greatly reduced by the poor condition of the soil and by the erratic rainfall. There are signs that some of the grasses, particularly the R.M.E. Napier and the Kazungula Setaria, P.1192, may have been killed off during the 1950 dry season and the future results will be interesting. In future no grasses will be replaced and so those that succumb to droughts or other causes will be automatically eliminated.

The chemical composition data shown in Table VI are interesting, but it is felt that they do not entirely reflect the true position as it was not always possible to cut plots at the optimum stage for ensilage. In many cases the herbage was allowed to become too old, with a resultant loss in feeding value. It is interesting to note, however, that almost without fail, the crude protein content of the grasses at the close spacings was lower than that of those at 3-feet x 6-feet spacings, which in turn was lower than the percentage crude protein of the grasses at the widest espacements. The production of crude protein in pounds per acre, however, somewhat reverses the position.

So far the two West African Elephant Grasses are the outstanding grasses at all spacings, and do not appear yet to be suffering from lack of space. The Kazungula Setaria, P.1193, did well at all spacings during the first season, but dropped off considerably during the second. This was probably due more to the rainfall than to anything else. The Echinochloa on the other hand did well the second year at all espacements, but badly in the first season. It is probable that this was brought about chiefly by stool enlargement as these have increased considerably in size since the year of establishment.

The yields of R.M.E. Napier and the Kazungula Setaria, P.1192, have been poor at all espacements throughout, while the Guinea Grass improved considerably in the second season.

Combining all spacings, the Gold Coast and Cameroons Elephant Grasses have been the best perennials throughout, although in the first season their yields were equalled by the Kazungula Setaria, P.1193, and in the second by the Echinochloa. The R.M.E. Napier has given the lowest yields consistently.

In the first season the Sorghum out-yielded the Nyouti, which did better than the Maize, but in the second there was no significant difference between any of the yields of the annuals. Over the two seasons, the Sorghum did the best, whilst Maize and Nyouti gave similar yields.

Not only is the yield of a crop important, but economics enter into the question as well. The cost of planting and maintaining a perennial crop such as Elephant Grass is undoubtedly lower than the costs incurred in producing annual crops.

A heavy-yielding perennial grass to be used for ensilage would fit in admirably in a long-term crop rotation. Unfortunately, grass is very seldom recognised as a crop. More often than not the farmer regards it as "something for nothing," and does not give it the care it deserves. Grass, therefore, by virtue of the fact that it is hardy and is undoubtedly one of our most valuable assets, is usually taken for granted and is seldom properly managed.

## VI. SUMMARY.

A preliminary report has been presented on the first two seasons' results of an experiment in which the yields of seven heavy-yielding perennial grasses and of three annual crops are compared. The experiment will continue for several years, but the results to date are interesting.

It has been shown that while a good silage Sorghum out-yielded the best perennial grasses in the first season, and while Nyouti gave more than all of the perennial grasses except Gold Elephant Grass at spacings of 3-feet x 3-feet and 3-feet x 6-feet and Cameroons Elephant Grass and Kazungula Setaria, P.1193, both at spacings of 3-feet x 3-feet, the perennial grasses did considerably better during the second season. The average yields for the two seasons place the Sorghum and Nyouti with Gold Coast, Cameroons, the Echinochloa and the Kazungula Setaria, P.1193. Maize was out-yielded by these better perennial grasses.

No differences have yet become apparent with regard to spacings, although it is probable that in future years the plots at the closer spacings will deteriorate.

The West African Elephant Grasses have given the best results to date in company with Sorghum, Nyouti, the Echinochloa and Kazungula Setaria, P.1193.

The need for the inclusion of perennial crops in arable rotations is stressed.

## VII. REFERENCES.

(1) HALL, SIR D.—"The Soil: An Introduction to the Scientic Study of the Growth of Crops."

(2) FISHER, R. A.—"Statistical Methods for Research Workers."

(3) FISHER, R. A., and YATES, F.—"Statistical Tables for Biological, Agricultural and Medical Research."

(4) PATERSON, D. D.—"Statistical Technique in Agricultural Research."

## VIII. ACKNOWLEDGMENTS.

The writer wishes to thank Dr. O. West, the Senior Pasture Research Officer, Central Veld and Pasture Station for Matabeleland, under whose helpful guidance the work was carried out.

Thanks are also due to Dr. Codd of the Prinshoff Grass Breeding Station, Pretoria, from whom stocks of many of the grasses were originally obtained; to the Manager, Salisbury Experimental Station, who supplied the Guinea Grass; and to Mr. T. K. Sansom, Senior Field Husbandry Officer, who provided seed and advice on annual crops.

The writer is also indebted to other members of the Professional and Technical Staff of the Central Veld and Pasture Station for Matabeleland, who afforded very considerable help; and to Dr. H. Weinmann, Pasture Research Chemist, who has undertaken all the chemical analyses.

# Price List of Forest-tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds

OBTAINABLE AT THE GOVERNMENT FOREST NURSERY, SALISBURY

AS AT 1st NOVEMBER, 1950

1. Transplants of forest trees, etc., are obtainable at the subjoined rates and subject to stocks and containers being available.

2. Orders should be addressed to the Chief Conservator of Forests, Salisbury; or Manager, Forest Nursery, P.O. Box 111, Causeway, Salisbury.

3. **All orders must be accompanied by a remittance in cash, bank note, postal order, draft or cheque, made payable to the Department of Agriculture, Salisbury. Under no circumstances will plants or seeds be sent out or taken away from the Nurseries unless paid for. Stamps to the value of one shilling will be accepted.**

4. All transplants are despatched at Rate 10 on railways at purchaser's risk. The transplants are watered as far as this is possible by the railway staff.

5. All prices quoted are for delivery free at any railway station or siding in Southern Rhodesia. **Road motor service charges are payable by consignee and must be included in remittances, otherwise plants will be railed to nearest Station or Siding.**

6. Purchasers of trees contained in boxes of 50 trees are requested to return boxes, carriage forward, to the nursery from which they are obtained, or to the Manager, Forest Nursery, Salisbury. **If the boxes are not returned within two months from date of issue, they will be charged for at 1/- each respectively.**

7. Forest tree transplants only will be reserved and no guarantee can be given that ornamental trees, shrubs and climbers listed will be available. Orders for over 1,000 conifers should be

placed not later than the 30th April and for over 1,000 Eucalypts not later than the 31st August immediately preceding the planting season. Orders will be executed in order of receipt and every effort will be made to comply with instructions of purchasers.

8. Transplants of forest trees, when quoted at per 1,000, are grown in boxes containing 50 transplants. The average weight of box is 50 lbs.

9. Shrubs and ornamental plants in single tins have a weight of about 5 lbs.

10. To purchasers of forest trees only, the following reductions are made:

(a) When the number exceeds 1,000, the price is £3 5s. per 1,000.

(b) When the number exceeds 5,000, the price is £2 14s. per 1,000.

11. Orders for seed are posted or railed free of charge.

12. Though every care is taken to supply trees and seeds true to name and of good quality, no guarantee can be given in this respect, more particularly in regard to seed.

13. Intending tree planters are invited to apply to the Chief Conservator of Forests, Division of Forestry, Salisbury, for advice as to the most suitable trees for growing in the various climates and soils of the Colony, and on the best methods to adopt in the formation of plantations, wind breaks and shelter belts.

14. **No responsibility taken after trees, shrubs, etc., have been accepted by the Railways. Any claim for loss or death should be made to the Railway Company.**

15. This list cancels all previous lists.

16. Hours of Business: Weekdays, 9 a.m. to 1 p.m. and 2 p.m. to 4.30 p.m. Saturdays, 9 to 11 a.m. Closed on Sundays and Public Holidays.

**Price of Transplants.** For convenience, the following symbols are used to indicate the purchase prices of transplants:

A—Trees, 50 in box, 4s. 6d. per box; £3 5s. per 1,000; £2 14s. per 1,000 for orders over 5,000.

E—Trees and shrubs from 1s. each unless otherwise stated Larger trees in half petrol tins from 3s. each.

| Botanical Name | Common Name | Remarks | Price of trans-plants | Price of seed Lb. | Price of seed Oz. |
|---|---|---|---|---|---|
| Callitris calcarata | Black cypress pine | Usually rather slow growing, but reaches a fair size and produces a valuable durable softwood. Suited for dry country planting, especially in sandy soil. Good shelter for orchards, etc. | A.E. | 15s. | 1s. |
| Casuarina cunninghamiana | Beefwood | A fine large shade tree, suitable for avenues and narrow belts. Requires deep soil in drier localities. The foliage is useful for stock fodder, and the tree stands lopping well. | A.E. | | 2s. pkt. 1s. |
| Cedrela mexicana | — | A rapid-growing, handsome semi-deciduous tree. Approximately intermediate between C. odorata and C. toona. | E. | | |
| Cedrela odorata | — | A rapid-growing tree similar to Cedrela toona, but with lighter foliage. Likely to do well on heavy soils, fairly free from frost. 30 to 40 feet in height. | E. | | |
| Cedrela toona | Toon tree | A rapid-growing, handsome, semi-deciduous tree, suited for moister localities where frost is slight. Yields a valuable soft timber. Recommended for shade and ornament. | A.E. | 15s. | 1s. |
| Cryptomeria japonica | Japanese cedar | A quick-growing coniferous tree, only suitable for high rainfall areas. | E. | | |
| Cupressus arizonica | Arizona cypress | A hardy evergreen tree, suitable for dry localities, but requiring a well-drained and rather deep soil. Useful for shelter belts and also for hedges when closely planted. | A.E. | 15s. | 1s. |
| Cupressus lawsoniana | Lawson's cypress | A handsome slow-growing cypress best suited to the mist belt and higher altitudes. | E. | | |

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|---|---|---|---|---|---|
| Cupressus lusitanica .. | Portuguese cypress ..... | A fast-growing cypress, producing an excellent soft-wood timber, but requires a moist, cool climate and a good soil. May well be used for shelter and hedges in favourable localities. | A.E. | 5s. | 6d. |
| Cupressus sempervirens, var. stricta | Common upright cypress | An ornamental tree for gardens and cemeteries. Also useful as a shelter tree. | E. | 15s. | 1s. |
| Cupressus torulosa ..... | Himalayan cypress ..... | A good tree for timber, hedges and shelter. Withstands much cold and drought. Not very soil exacting, but will not stand waterlogging. Fairly frost-hardy. A very reliable tree. | A.E. | 10s. | 9d. |
| Eucalyptus botryoides | Bangalay ..... | A large-leaved, heavy-foliaged gum. Quick growing. Suitable for granite and red soils. Withstands frosts, but not very drought-resistant. | A. | 15s. | 1s. |
| Eucalyptus citriodora | Lemon-scented gum ..... | A clean-boled tree, producing an excellent timber. Leaves lemon-scented. Suited for wetter regions and on the better soils in the lower rainfall regions. Will not withstand much frost or drought. Flowers prolifically, rendering it very useful for honey production. | A. | 15s. | 1s. |
| Eucalyptus crebra ..... | Narrow-leaved ironbark | A slow-growing, deep-rooting species, producing excellent timber. Withstands drought and light frosts. | A. | 15s. | 1s. |
| Eucalyptus ficifolia .. | Red flowering gum ..... | A small tree with showy flowers. Grows better in the higher rainfall areas. | E. | | |
| Eucalyptus maculata .. | Spotted gum ..... ..... | One of the best trees for timber production or shelter in the wetter areas, being fairly hardy to drought but not to frost. Produces an excellent timber. | A | 15s. | 1s. |
| Eucalyptus maideni .. | Maiden's gum ..... ..... | A very-fast growing, large tree, with bluish foliage in youth. Fairly drought and frost resistant. Will grow on poor soils if deep and well-drained. Produces a good, strong, useful timber. | A. | 30s. | 2s. |

| Botanical Name | Common Name | Remarks | Price of trans-plants | Price of seed Lb. | Price of seed Oz. |
|---|---|---|---|---|---|
| Eucalyptus melliodor | Yellow box | A medium-sized tree, useful for shelter belts. Produces a tough, durable timber. Very resistant to drought and frost. Valuable for honey production, having abundant sweet flowers. | A. | 15s. | 1s. |
| Eucalyptus microcorys | Tallow-wood | A neat, heavily-foliaged tree suitable for high rainfall areas. | A | 15s. | 1s. |
| Eucalyptus paniculata | Grey ironbark | A very good timber tree, with heavy foliage. Suitable for the moister regions, with a deep, fertile soil. Withstands some drought, but is frost-tender. Yields an excellet, hard, durable wood. | A. | 15s. | 1s. |
| Eucalyptus punctata | Leather jacket | A tree of fair size, yielding a good, durable timber. Adaptable as regards soil and climate, but will not withstand a dry cold climate. | A. | 15s. | 1s. |
| Eucalyptus rostrata | Red gum | Produces an excellent and durable hardwood. Withstands drought, heat, brak, flooding and a good deal of frost. One of the best species for planting in Southern Rhodesia, except in sour soil and wet mountain regions. | A. | 15s. | 1s. |
| Eucalyptus saligna | Sydney blue gum | A fast-growing, useful tree, producing a useful medium hardwood. Thrives on deep, fertile soils in the heavier rainfall areas. Tender to frost and drought. | A. | 15s. | 1s. |
| Eucalyptus tereticornis | Forest red gum | Similar to Eucalyptus rostrata, and can be planted along with it, except in areas liable to flooding and great heat. Perhaps not quite as drought-resistant. | A. | 15s. | 1s. |

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|---|---|---|---|---|---|
| Grevillea robusta | Silky oak | A handsome tree which thrives best in moist, warm localities. Useful for ornament, shade and timber. Frost-tender and not resistant to drought. If the locality is unsuitable, it may grow well for several years and then die out. | E. | | |
| Jacaranda mimosifolia | Jacaranda | An ornamental deciduous tree with feathery foliage and abundant blue flowers, which appear in spring. Best development is attained in the moister regions, but the tree withstands drought to a surprising extent, and may be planted in the drier regions if the soil is reasonably deep and fertile. It is tender to cold and frost, and may need protection in its earlier youth. | E. | | |
| Pinus canariensis | Canary Island Pine | Hardy to drought, but not to severe frost. Best suited for planting on higher altitudes and in higher rainfall areas. Slow growth in early youth, then more rapid in later years. A handsome tree with inverted, umbrella-like branches, not spreading. Yields an excellent softwood timber. | A.E. | 15s. | 1s. |
| Pinus caribaea | Slash Pine | A pine suitable for the higher rainfall areas. Not successful on poor, dry sites. | A.E. | | |
| Pinus halepensis | Aleppo pine | A drought-resistant pine which will grow on limestone and shale soils. Not recommended for plantations, but can be used for shelter and ornamental purposes in the drier regions. | A.E. | 15s. | 1s. |
| Pinus patula | Patula pine | A fast-growing pine with graceful drooping needles. Does best in higher rainfall areas. Produces a useful softwood. | A.E. | 15s. | 1s. |

| Botanical Name | Common Name | Remarks | Price of trans-plants | Price of seed Lb. | Price of seed Oz. |
|---|---|---|---|---|---|
| Pinus radiata (insignis) | Remarkable pine | A large tree of very rapid growth, producing a useful softwood. Most at home in the heavier rainfall areas. Does not like sour or poorly-drained soils. Frost-hardy but not drought-resistant, usually failing at an early age in the drier regions. It should be planted with caution in areas under 30-inch rainfall. Recently this tree has been severely attacked by *Diplodia pinea* and it is advised that the Forest Department be consulted when new plantations are contemplated. | A.E. | 15s. | 1s. |
| Pinus longifolia | Chir pine | A somewhat slow-growing pine, but useful to plant in localities where the climate and soil are doubtful at the higher elevations. For timber and ornamental purposes. A useful tree in all respects. | A.E. | 15s. | 1s. |
| Pinus taeda | Loblolly pine | A pine suitable for the higher rainfall areas. | A.E. | | |
| Populus alba | White poplar | A rapid-growing poplar, requiring a good, deep soil in close proximity to running water. Propagated by suckers. Deciduous. | Suckers at 9s. per 100 | | |
| Populus deltoides, var. missouriensis | Carolina poplar | A very fast-growing poplar, producing a very good timber for matches. Requires a rich, moist, alluvial soil. Moderately frost-hardy. Does not like stagnant water. | E. | | |
| Salix babylonica | Weeping willow | A useful timber and ornamental tree, requiring a moist, well-drained soil which is occasionally flooded. Not suited for ground in which water is stagnant. | 4d. each | | |
| Salix caprea | Goat willow | A shrub or small tree preferring moist well-drained soil and occasional flooding. | 4d. each. | | |
| Salix purpurea | Purple willow | As for Salix caprea. | 4d. each. | | |
| Salix viminalis | Common osier | As for Salix caprea. | 4d. each. | | |

## Ornamental Trees, Shrubs and Hedge Plants

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|---|---|---|---|
| Abelia floribunda | — | A shrub with myrtle-like leaves, evergreen if watered. Pink-white flowers in profusion. Is used for hedges in Natal. | E. |
| Acacia baileyana | Bailey's Wattle | A small tree with beautiful foliage and yellow flowers. | E. |
| Acer negundo | Box elder | A medium-sized ornamental tree suited to the better rainfall areas. | E. |
| Acrocarpus fraxinifolius | — | A small tree up to 40 feet in height; attractive foliage. Fast growing. | E. |
| Alstonia scholaris | — | A white-flowered shrub, 6 feet high, similar to Oleander. | E. |
| Bauhinia acuminata | Bauhinia | A small tree, flowering profusely in early spring. White flowers. Hardy. | E. |
| Bauhinia punctata | Pride of de Kaap | A rambling shrub, bearing orange-red flowers. Hardy. | E. |
| Bauhinia purpurea | Bauhinia | Similar to the Bauhinia acuminata, but with mauve flowers. Hardy. | E. |
| Bolusanthus speciosus | Rhodesian tree wisteria | An indigenous semi-deciduous tree with blue flowers at the end of long stalks. Ornamental. | E. |
| Buddleia sp. | Blue buddleia | A medium-sized shrub with sweet-scented blue flowers. Useful as a hedge. Rapid-growing, but frost-tender. | E. |
| Buddleia sp. | Yellow buddleia | A rank-growing, yellow-flowering shrub. Rapid-growing. Frost tender. Both Buddleias are very subject to leaf-eating beetles. | E. |
| Callistemon speciosus | Bottlebrush | A scarlet-flowering shrub of drooping habit. Makes an excellent hedge if trimmed along the top only. | E. |
| Calodendron capense | Cape chestnut | A fine flowering tree, with white spotted purple flowers, but rather slow. Prefers the moister localities. | E. |

| Botanical Name | Common Name | Remarks | Price of trans-plants | Price of seed Lb. | Price of seed Oz. |
|---|---|---|---|---|---|
| Casimiroa edulis | Mexican apple | A large, rapid-growing tree, 30-40 feet in height, evergreen, and bears a delicious fruit. A fine shade tree if pruned to stake early. | E. | | |
| Cassia capensis | Cape laburnum | A rapidly growing shrub, bearing masses of bright yellow flowers. | E. | | |
| Cassia caruda | — | Tree up to 20 feet high with masses of yellow flowers. | E. | | |
| Cassia siamea | — | Grows fairly rapidly and is easy to cultivate. Yellow flowers. | E. | | |
| Cassia spectabilis | — | A native of Tropical America. Grows fairly rapidly and produces masses of yellow flowers. Tends to be bushy and so requires pruning. | E. | | |
| Castanospermum australe | Australian chestnut | A very fine shade tree similar in growth to Cedrela but with shiny evergreen leaves and pretty flowers. Seeds poisonous. | E. | | |
| Ceiba pendandra | Kapok | A tree with a spiny trunk and showy rose-coloured flowers. | E. | | |
| Citharexylum sp. | — | A deciduous shrub up to 15 ft. in height. Grown for its lovely leaves, which become highly coloured in autumn. | E. | | |
| Croton sylvaticus | Mount Selinda linden | A large-leaved, deciduous tree from Melsetter. | E. | | |
| Cyphomandra betacea | Tree tomato | The well-known tree tomato. Will grow anywhere where Paw Paws will thrive. | E. | | |
| Dais cotinifolia | — | Small indigenous tree producing small heads of lilac-like flowers. | E. | | |
| Delonix regia | Flamboyant | A handsome red-flowering, feathery-foliaged tree. Very frost tender. Flowers best on stony ground. | E. | | |
| Dodonea viscosa | — | Indigenous shrub. Makes a good hedge in Matabeleland, but dies out after a few years in Mashonaland. | A.E. | | |

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|---|---|---|---|
| Duranta alba | White tree forget-me-not | Similar to Duranta repens but has white flowers. | E. |
| Duranta repens | Tree forget-me-not | A medium-sized, deciduous shrub with blue flowers. Useful as a hedge. Very hardy. | E. |
| Ekebergia capensis | — | An attractive fairly fast-growing tree. | E. |
| Eranthemum sp. | — | A shrubby herbaceous plant covered with intense blue flowers in the autumn. Likes shade. Evergreen. 3 feet high. | E. |
| Eugenia braziliensis | Brazilian cherry | A small shrub, bearing scarlet-coloured, edible fruits. A useful hedge plant. | E. |
| Euphorbia splendens | Christ thorn | A small thorny shrub with bright scarlet flowers. Suitable for low hedges and borders. | E. |
| Fraxinus berlanderiana | Mexican ash | A useful ornamental tree. | E. |
| Gleditsia triacanthos | Honey locust | A hardy tree with prominent thorns. | E. |
| Hamelia patens | — | A compact shrub 8 feet to 10 feet in height, flower orange-yellow tubes, a showy shrub. | E. |
| Heliotropium peruvianum | Heliotrope | A small shrub with sweet-scented lilac or nearly white flowers. Suitable in flower border. | E. |
| Holmskioldia sanguinea | Holmskioldia | A fairly hardy shrub, bearing a profusion of brick-red flowers in large bunches Suitable for hedges. | E. |
| Holmskioldia sp. | Holmskioldia | A yellow-flowering, handsome shrub similar to Holmskioldia sanguinea. | E. |
| Holmskioldia sp. | Holmskioldia | Similar to the above but mauve bracts and blue flowers. | E. |
| Hypericum lanceolatum | St. John's wort | A small, yellow-flowering shrub. Multitudes of flowers. | E. |
| Iboza riparia | Rhodesian spirea | A medium-sized blue flowering shrub. | E. |
| Iochroma tubulosa | Iochroma | A shrub with dark blue flowers. | E. |
| Jasminum primulinum | — | A rambling free-flowering shrub with primrose-yellow flowers. | E. |

| Botanical Name | Common Name | Remarks | Price of transplants | Price of seed Lb. | Price of seed Oz. |
|---|---|---|---|---|---|
| Khaya nyasica | Banket mahogany | An evergreen timber tree, fairly fast-growing on deep soils. | E. | | |
| Lagerstrœmia eavesii | Mauve Pride of India | Similar to Lagerstroemia indica but has mauve flowers. | E. | | |
| Lagerstroemia indica | Pride of India | A large ornamental shrub, with pink flowers. Handsome and hardy. | E. | | |
| Ligustrum lucidum | Chinese privet | An excellent hedge plant or ornamental shrub or tree. Can be clipped into shape. Liable to die off in patches or lose its lower leaves unless planted in moist soil of fair depth. Propagated from cuttings or seeds. | A. | | |
| Lagunaria patersonii | — | An evergreen tree with pink flowers, 30 feet high. | E. | | |
| Mangifera indica | Mango | The well-known fruit tree. | E. | | |
| Melia azedarach | Syringa | A deciduous tree, producing a good light timber. Shallow rooting. Withstands drought well. Has fine lilac flowers and persistent yellow berries. Suitable for better rainfall areas and deep sandy soil, but will grow under severe conditions. | E. | | |
| Morus nigra | Common Mulberry | A very large fruited variety. | E. | | |
| Parkinsonia aculeata | Jerusalem thorn | A light-foliaged tree, up to 20 feet high, with little yellow flowers. Very beautiful as isolated specimen on a lawn. | E. | | |
| Peltophorum africanum | Rhodesian wattle | Indigenous tree with yellow flowers. | E. | | |
| Photinia japonica | Loquat | A small evergreen tree with large leaves, bearing yellow edible fruit. | E. | | |
| Phytolacca dioica | Belhambra | A rapid-growing, deciduous tree. Useful for ornament. Timber of no value, but seeds valuable as a poultry or cattle feed. | A. | | |

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| Pittosporum undulatum | Camphor laurel ... | An Australian evergreen shrub, making an excellent hedge, with shining, green, scented leaves and scented berries. | A. |
| Platanus wrightii ..... | Arizona sycamore ..... | A useful ornamental tree which can grow to a large size. | E. |
| Poinsettia pulcherrima | Poinsettia ..... ..... ..... | A shrub with small yellow flowers surrounded by many large, scarlet, leaf-like bracts. Very showy. Double and single varieties. Also single pink variety. | E. |
| Poinsettia albida . . | Poinsettia . . ..... ..... | As above, but with single yellowish white bracts. | E. |
| Punica granatum ..... | Fruiting pomegranate | A shrub or small tree, having shining deciduous leaves, large scarlet flowers and large red fruit Makes a useful hedge when well cut regularly. | E. |
| Punica granatum flora pleni | Double flowered pomegranate | A useful shrub with double scarlet flowers. Does not bear fruit. | E. |
| Pyracantha angustifolia | Hawthorn ..... ..... ..... | Fruits golden, and hang throughout the winter. Evergreen shrub. Useful as a coarse hedge. | A.E. |
| Pyracantha crenulata | Hawthorn ..... ..... ..... | Fruits scarlet. Evergreen shrub if watered in winter. Makes a good border or low hedge. | A.E. |
| Rhus lancea ..... ..... | Karreeboom ... ..... | A small indigenous tree of graceful appearance, yielding a very durable wood. Useful for ornamental purposes. Forms a fine hedge | A.E. |
| Salvia involucrata ..... | — | A large herbaceous shrub. Rosy-crimson flowers in late summer. Tender to frost. | E. |
| Sapindus mukorossi .. | Soapberry ..... ..... ..... | Evergreen shade tree of medium height. | E. |
| Schinus molle ..... ..... | Pepper tree ..... ..... | A small evergreen tree with pendulous twigs and rose-coloured berries. Enjoys a hot sunny position but will mildew badly in humid heat. Suitable for the drier areas of the Colony only. | E. |
| Schinus. terebinthifolius | Brazil pepper tree ..... | A small to large-spreading evergreen tree which is covered in Spring with small red berries. | E. |

| Botanical Name | Common Name | Remarks | Price of trans-plants | Price of seed Lb. | Price of seed Oz. |
|---|---|---|---|---|---|
| Schizolobium excelsum | Giant feather duster tree | A tall quick-growing tree from Brazil. The bark is smooth and the leaves all at the top of the tree are very large. The flowers in large panicles are yellow. | E. | | |
| Spathodea campanulata | African flame tree ..... | A handsome, heavy-foliaged tree, bearing bright red flowers. Suited for the heavier rainfall areas on deep soils. Frost tender. | E. | | |
| Spirea prunifolia ..... | Cape May ..... ..... ..... | White-flowered shrub four feet in height, in single and double varieties. | E. | | |
| Sterculia acerifolia ..... | Australian flame tree | Medium-size deciduous tree bearing masses of scarlet flowers in November. | E. | | |
| Sterculia discolor ..... | White Kurrajong ..... | Recommended as a shade tree for the hot dry areas of the Colony. | E. | | |
| Sterculia diversifolia .. | Black Kurrajong ..... | An evergreen tree up to 30 feet high with greenish-yellow flowers. Should do well in the hot, dry parts of the Colony. | E. | | |
| Streptosolon jamesonii | Streptosolon ..... ..... | A shrub with orange-coloured flowers in dense masses and pale-green foliage. Very frost-tender and delicate. | E. | | |
| Tecoma smithii ..... ..... | Tecoma ..... ..... ..... | An upright, medium-sized shrub with tubular, bright yellow flowers. Forms a useful hedge. Fairly drought-resistant. | E. | | pkt. 1s. |
| Tecomaria capensis .. | Kaffir honeysuckle ..... | A pretty trailing shrub from the Cape, with orange flowers. | E. | | |
| Thevetia peruvianum | Thevetia ..... ..... ..... | Evergreen shrub with narrow shiny leaves. Flowers yellow. Poisonous. | E. | | |
| Thuya orientalis ..... | Thuya ..... ..... ..... ..... | A very hardy conifer that withstands heat, cold and drought, and does not mind heavy soils. Slow-growing. Of small size. Very good for hedges. | E. | | pkt. 1s. |

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| Tipuana speciosa | Tipu tree | A small tree inclined to be spindly at first, but eventually makes quite a good tree. Light foliage, and yellow flowers about the end of October. | E. |
| Trichilia emetica | Natal mahogany | A fine shade tree, evergreen, slow in growth, height to 30 feet, spread up to 50 feet. | E. |
| Ulmus parvifolia | Chinese elm | Small tree with spreading branches. Hardy. | E. |
| Vitex agnus-castus | Hemp tree | A showy blue-flowered shrub, does well in the most unlikely places. | E. |
| | | **Climbers and Creepers** | |
| Antigonon leptopus | Coral creeper | A showy climber, bright pink flowers, forms large bulbs underground. Takes two or three years to reach flowering size, after this it makes a wonderful display yearly. | E. |
| Bignonia chrysoleuca | Lemon shower | Similar to Golden Shower with lemon-coloured flowers. Deciduous. | E. |
| Bignonia jasminoides | — | An evergreen climber with mauve-throated white flowers. | E. |
| Bignonia tweediana | — | A self-clinging climber with yellow flowers. Very showy whilst in flower. | E. |
| Bougainvillæa splendens | Bougainvillaea | Vigorous climber. May be also used as a hedge. Bracts magenta. Fairly frost-hardy. | E. |
| Ficus repens | — | A valuable climber for walls, etc., used in places where the Virginia creeper is grown, but clings to the surface much better than the latter, rather slow at first. | E. |
| Jasminum sambac | Jasmine | A vigorous, evergreen shrub climber with large trusses of fragrant, white flowers. | E. |
| Lonicera periclymenum | Honesuckle (Woodbine) | Hardy climber with sweet-scented yellow flowers. | E. |

| Botanical Name | Common Name | Remarks | Price of trans-plants | Price of seed Lb. | Price of seed Oz. |
|---|---|---|---|---|---|
| Podranea brycei | Zimbabwe creeper | A rank-growing indigenous creeper with large, pink flowers. | E. | | |
| Pyrostegia venusta | Golden shower | Vigorous creeper. Rapid-growing. Bears masses of orange flowers all the year round. Very useful and hardy. | E. | | |
| | | **Bamboos, etc.** | | | |
| Arundo donax | Spanish reed | A reed, growing 20 feet to 25 feet in height and 1 inch thick, and very superior to the indigenous variety. | Offsets 1s. 6d. each | | |
| Bambusa arundinacea | Whipstick bamboo | About 30 feet. | Offsets 2s. 6d. each | | |
| Bambusa sp. | Indian variety | Similar in growth to the Bindura, with very useful rods. | Offsets 2s. 6d. each | | |
| Oxytenanthera abyssinica | The Bindura bamboo | The only variety indigenous to Rhodesia, giving very useful solid rods, very tough. | Offsets 2s. 6d. each | | |

Offsets of Bamboos supplied during rainy season only.

# Departmental Bulletins

Copies of these Bulletins may be obtained from the Editor, Box 25, Causeway, Salisbury. They are issued to residents of Southern Rhodesia at a charge of 3d., 6d. and 1s. per copy; and at 6d., 1s. and 2s. per copy outside the Colony. The 6d. and 1s. bulletins are marked with an asterisk.

N.B.—The date the article appeared in the Journal is indicated in abbreviated form before the number, e.g., 3/31 No. 815, means that Bulletin 815 appeared in the Journal for March, 1931.

## AGRICULTURE AND CROPS.

3/31. No. 815. New strains of Oats for Southern Rhodesia, by H. C. Arnold, Manager, Agricultural Experiment Station, Salisbury.

5/31. No. 822. Re-stacking of Maize rejected for Export on account of Excessive Moisture.

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2/33. No. 878. A.I.V. Silage: Memorandum prepared and circulated by Imperial Bureau of Animal Nutrition.

8/36. No. 997. Reward Wheat: Report on the Baking Properties and Chemical Analyses, by The Rhodesian Milling and Manufacturing Co., Ltd.

7/41. No. 1176. Costings of Farm Operations on the Witchweed Demonstration Farm, Auchendinny, Season 1939-40, by S. D. Timson, M.C., Agriculturist; and G. L. Black, Dip. Agric. (Durham), Manager.

11-12/42. No. 1221. A Description of the more common Rhodesian Wheat Varieties, by T. K. Sansom, B.Sc., Plant Breeder.

3-4/43. No. 1230. Costings of Farm Operations on the Witchweed Demonstration Farm, Auchendinny, Season 1941-42, by S. D. Timson, M.C., Agriculturist; and G. L. Black, Dip. Agric. (Durham), Manager.

9-10/43. No. 1242. Pyrethrum, by H. C. Arnold, Manager, Agricultural Experiment Station.

5-6/44. No. 1265. Notes on Growing Sweet Potatoes, by the Agricultural Branch.

9-10/44. No. 1271. Pyrethrum Drying, by V. A. Beckly, M.C., M.A., A.I.C., and F. McNaughton, B.Sc. (Hons.), Dept. of Agriculture, Kenya.

5-6/45. No. 1305. Wheat Production in Southern Rhodesia, by D. E. McLoughlin, Acting Chief Agriculturist, and T. K. Sansom, B.Sc., Plant Breeder.

9-10 45. No. 1317 Wheat: Examination of the 1944 Southern Rhodesia Crop, by P. Fuller, Chemist, The Rhodesia Milling & Manufacturing Co., Ltd., Bulawayo.

1-2/46. No. 1337. Green Manuring: When to Plough Down the Crop, by S. D. Timson, M.C., Agriculturist.

4-5/46. No. 1341. *The Potato.

7-8/46. No. 1356. Wheat: An examination of the 1945 S.R. Crop, by P. Fuller, Chemist, The Rhodesian Milling & Manufacturing Co., Ltd., Bulawayo.

3-4/47. No. 1387. Wheat: An Examination of the 1946 S.R. Crop, by P. Fuller, Chemist, The Rhodesian Milling & Manufacturing Co., Ltd., Bulawayo.

9-10/47. No. 1415. The Sunflower (*Helianthus annuus*), by S. D. Timson, M.C., Agriculturist.

9-10/47. No. 1416. Kraal Compost, by S. D. Timson, M.C., Agriculturist.

11-12/47. No. 1422. Alternate Green Manure Crops, by S. D. Timson, M.C., Agriculturist.

11-12/47. No. 1426. An Improved Implement for use in Compost Making, by J. D. Scott.

3-4/48. No. 1437. Soya Beans, by H. C. Arnold, Agricultural Experiment Station.

5-6/48. No. 1441. Mechanisation at Gwebi: the "Multiple Hitch," by F. P. Orsmond, Superintendent of the Government Farm, Gwebi.

9-10/48. No. 1453. Report on Southern Rhodesia Wheat Crop by Mr. Blair, Rhodesian Milling Manufacturing Co. Salisbury.

3-4/49. No. 1479. Silage and Silos by W. J. Spafford, Department Agriculture, South Australia.

5-6/49. No. 1483. Why must Root Crops be Hoed by E. W. Russel. Rothamsted and Method of Application of Fertiliser and Green Manure Trials extracted from Salisbury Agricultural Experiment Station Annual Report, Bulletin 830.

5-6/50. No. 1522. Hybrid Maize: Preliminary Disease Resistance Tests, by I. A. C. Ferguson.

*Lucerne Cyclostyled Number.

## ANNUAL REPORTS.

7/27. No. 649. Annual Report of Experiments, 1925-26, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

9/31. No. 830. Annual Report of Experiments, 1929-30, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

6/33. No. 895. Annual Report of Experiments, 1931-32, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

6/35. No. 956. Annual Report of Division of Irrigation for 1934 by P. H. Haviland, B.Sc. (Eng.), Acting Chief Irrigation Engineer.

6/35. No. 957. Annual Report of the Branch of Plant Pathology for 1934 by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

8/35. No. 962. Annual Report of Chief Entomologist for 1934, by R. W. Jack, Chief Entomologist.

9/35. No. 965. Annual Report of Experiments 1933-34, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

12/35. No. 974. Summary of Annual Report of Division of Forestry for 1934, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Chief Forest Officer.

5/36. No. 986. Annual Report of the Division of Entomology for 1935, by R. W. Jack, Chief Entomologist.

6/36. No. 992. Annual Report of the Agriculturist for the year 1935, by D. E. McLoughlin, Agriculturist.

7/38. No. 1076. Annual Report of Division of Forestry for 1937, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.

8/39. No. 1122. Annual Report of the Branch of Plant Pathology for 1938, by J. C. F. Hopkins, D.Sc. (Lond.) A.I.C.T.A., Senior Plant Pathologist.

4/40. No. 1149. Annual Report on Experiments, Agricultural Experiment Station, Salisbury, 1938-1939, by H. C. Arnold, Manager.

5/41. No. 1173. Annual Report of Experiments, 1939-1940, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

3-4/42, No. 1200. Witchweed Demonstration Farm. Costings, 1940-41, by S. D. Timson, M.C., Assistant Agriculturist, and G. L. Black, Manager.

5/42. No. 1204. Annual Report of Experiments, 1940-41, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

7-8/43. No. 1237. Annual Report of Experiments, 1941-42, Agricultural Experiment Station, Salisbury, by H. C. Arnold, Manager.

7-8/44. No. 1268. Annual Report of Experiments, 1942-43, Agricultural Experiment Station, Salisbury, by H. C. Arnold, M.B.E., Manager.

3-4/45. No. 1301. Annual Report of Experiments, 1943-44, Agricultural Experiment Station, Salisbury, by H. C. Arnold, M.B.E., Manager.

7-8/45. No. 1311. Report of Secretary, Department of Lands, 1944.

9-10/45. No. 1319. Witchweed Demonstration Farm. Final Progress Report: December, 1944, by S. D. Timson, M.C., Agriculturist.

5-6/46. No. 1350. Annual Report of Irrigation Department for 1945.

7-8/46. No. 1355. Annual Report of Chief Animal Husbandry Officer for 1945

7-8/46. No. 1357. Annual Report of Central Food Production Committee for 1945.

7-8/46. No. 1359. Annual Report of the Branch of Botany and Plant Pathology for 1945, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

7-8/46. No. 1360. Annual Report of Experiments, 1944-45, Agricultural Experiment Station, Salisbury, by H. C. Arnold, M.B.E., Manager.

11-12/46. No. 1377. Annual Report, Division of Entomology, 1945, by J. K. Chorley, Chief Entomologist.

11-12/46. No. 1378. Annual Report of Chief Agriculturist, 1945, by D. E. McLoughlin, Chief Agriculturist.

1-2/47. No. 1383. Annual Report of Division of Forestry for 1945, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon.), Conservator of Forests.

7-8/46. No. 1399. Annual Report of Experiments, 1945-46, Agricultural Experiment Station, Salisbury, by H. C. Arnold, M.B.E., Manager.

7-8/47. No. 1404. Report of the Secretary, Department of Agriculture and Lands, 1946.

9-10/48. No. 1458. Annual Report of Experiments for 1946-47, Salisbury, Agricultural Experiment Station by H. C. Arnold, Manager.

11-12/48. No. 1459. Annual Report of Government Farms by D. E. McLoughlin, Chief Agriculturist.

1-2/49. No. 1468. Annual Report, Horticulturist for 1947, by C. N. Hayter, Horticulturist.

7-8/49. No. 1485. Summary of Annual Report of Department of Conservation and Extension for 1948, by C. A. Murray, Assistant Director Research and Specialist Services.

7-8/49. No. 1486. Summary of Annual Report of Chief Tobacco Officer for 1948, by D. D. Brown, Chief Tobacco Officer.

7-8/49. No. 1488. Summary of Annual Report of Chief Botanist and Plant Pathologist for 1948, by J. C. F. Hopkins, Chief Botanist and Plant Pathologist.

9-10/49. No. 1490. Annual Report of Experiments for 1947-48, Salisbury Agricultural Experiment Station, by A. G. H. Rattray, B.A.

3-4/50. No. 1515. Agricultural Experiment Station Annual Report, by A. G. H. Rattray, B.A. (Cantab.)

7-8/50. No. 1526. Summary of Annual Report of Secretary of Department of Agriculture for 1949, by A. E. Romyn.

7-8/50. No. 1527. Summary of Annual Report of Director of Irrigation for 1949, by P. H. Haviland.

7-8/50. No. 1528. Summary of 30th Annual Report of Chief Conservator of Forests for 1949, by E. J. Kelly Edwards.

7-8/50. No. 1529. Summary of Annual Report of Director of Veterinary Services for 1949, by P. D. Huston.

7-8/50. No. 1530. Summary of Annual Report of Chief Animal Husbandry Officer for 1949, by J. C. Raath.

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7-8/50. No. 1532. Summary of Annual Report of Chief Pasture Research Officer for 1949, by R. R. Staples.

7-8/50. No. 1533. Summary of Annual Report of Chief Tobacco Officer for 1949, by D. D. Brown.

7-8/50. No. 1534. Summary of Annual Report of Department of Conservation and Extension for 1949, by C. A. Murray.

7-8/50. No. 1535. Summary of Annual Report of Chief Entomologist for 1949, by M. C. Mossop.

7-8/50. No. 1536. Summary of Annual Report of Chief Agricultural Economist for 1949, by S. M. Makings.

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11-12/45. No. 1326. *Construction of Dipping Tanks, by B. G. Gundry, A.I.Mech.E., and Notes on their Management, by J. M. Sinclair, M.R.C.V.S., Chief Veterinary Surgeon.

1-2/46. No. 1334. *Piggeries, by B. G. Gundry, A.I.Mech.E., and A. E. Romyn, Ph.D.

3-4/47. No. 1389. *Reinforced Brick Grain Bins, by Grain Bag Shortage Committee.

1-2/48. No. 1432. *Buildings for Virginia Type Flue-cured Tobacco, by B. G. Gundry, Agricultural Engineer in collaboration with D. D. Brown, Chief Tobacco Officer.

9-10/48. No. 1455. Management of the Coal-burning Furnace for Tobacco Barns by Capt. C. E. Lowe, C.B.E., R.N., retired, Research Engineer, Tobacco Research Station, Trelawney.

5-6/49. No. 1481. A New Furnace Wall, by C. E. Lowe, C.B.E., R.N., retired, Research Engineer, Tobacco Research Station, Trelawney.

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5/35. No. 954. Experiments on the Toxicity to Fowls of Arsenite of Soda and Poisoned Locusts, by J. K. Chorley, F.R.E.S., and R. McChlery, B.A., B.Sc.

4/38. No. 1065. Nitrification in Red Soil in the Salisbury Area, by A. P. Taylor, M.A., B.Sc., and B. S. Ellis, B.Sc., A.I.C., D.I.C., Agricultural Chemists.

5-6/47. No. 1396. A Guide to Some Rhodesian Soils. Part I.

3-4/48. No. 1439. Seasonal Growth and Changes in Chemical Composition of the Herbage on Marandellas Sandveld, by H. Weinmann, D.Sc., Pasture Research Chemist.

11-12/49. No. 1498. Analyses of Rhodesia Foodstufls, by the Chemistry Branch.

1-2/50. No. 1508. A Guide to Some Rhodesian Soils. Part II. A Note on Mopani Soils, by B. S. Ellis, B.Sc., D.I.C., F.R.I.C.

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9-10/50. No. 1546. Some Notes on the Properties of Vermiculite in Relation to Its Use in Agriculture and Horticulture, by D. H. Saunder.

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9-10/50. No. 1543. Subsoiling in Relation to Agriculture, by K. J. Mackenzie and M. M. Cormack.

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3-4/43. No. 1228. *The Manufacture of Gouda Cheese, by The Dairy Branch.

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7-8/45, 9-10/45. No. 1321 Dairy Tests and Calculations, by The Dairy Branch.

7-8/47. No. 1400. Modern Milking, by The Dairy Branch.

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3-4/48. No. 1438. Cheese Making in the Home, by The Dairy Branch. Blue Prints of drawings of a Farm Dairy can be obtained from the Chief Dairy Officer.

9-10/48. No. 1454. *How to Produce Clean Milk, by J. R. Corry, B.Sc. (Agri.), Chief Dairy Officer.

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5-6/50. No. 1521. The Dairy Industry in Southern Rhodesia, by J. R Corry, B.Sc.

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8/25. No. 548. Insect Pests of Cotton, by C. B. Symes.

9/25. No. 553. Observations on some injurious markings of Oranges, by C. B. Symes, Entomologist.

7/30. No. 790. Control of Insect Pests of Citrus, by W. J. Hall, Ph.D., B.Sc.

10/30. No. 796. The Army Worm *(Lachygma exempta)*, by R. W. Jack, Chief Entomologist.

7/30. No. 790. Notes on the Control of Some of the More Important Insect Pests of Citrus in Southern Rhodesia, by W. J. Hall, Ph.D., B.Sc., Entomologist to the British South Africa Company in Southern Rhodesia.

5/33. No. 893. Experiments with Tsetse Fly Traps against *Glossina morsitans* in Southern Rhodesia, by R. W. Jack, Chief Entomologist.

3/34. No. 913. Locusts: Instructions for dealing with Flying Swarms, by The Division of Entomology.

12/34. No. 938. The Destruction and Control of Locust Hoppers, by R. W. Jack, Chief Entomologist.

5/36. No. 986. Annual Report of the Division of Entomology for year ending 31st December, 1935, by Rupert W. Jack, Chief Entomologist.

2/38. No. 1059. A Poison Bait for Young Locust Hoppers.

9/38. No. 1082. The Life History of Root Gallworm or Root Knot Eelworm, by M. C. Mossop, M.Sc., Entomologist.

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3-4/43. No. 1227. Plant Pests from Abroad, by M. C. Mossop, M.Sc., Entomologist.

11-12/43. No. 1249. On the Activity of the Tsetse *Glossina Pallidipes* and other Tsetse during a 24 hour period, by W. L. Williams, B.Sc., Entomologist.

3-4/44. No. 1259. Damage to Sapwood of Hardwoods by Powder-Post Beetles, by the Divisions of Forestry and Entomology.

11-12/44. No. 1283. Tsetse Fly Operations, 1943, by J. K. Chorley, Acting Chief Entomologist.

1-2/45. No. 1288. Orthezia Bug, by E. C. G. Pinhey, B.Sc., Entomologist.

3-4/45. No. 1303. Scientific Basis—Control of *Glossina morsitans* by Game Destruction, by The Trypanosomiasis Committee of Southern Rhodesia.

11-12/45. No. 1331. Tsetse Fly Operations: Short Survey of the Operations by Districts for the year ending December, 1944, by J. K. Chorley, Acting Chief Entomologist.

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3-4/48. No. 1436. The Use of Gammexane for the Control of White Grubs and Wire Worms in Tobacco Lands, by A. A. Moffet, Tobacco Research Station, Trelawney.

3-4/48. No. 1440. Control of Harvester Termites, by M. C. Mossop, M.Sc., Chief Entomologist.

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3-4/49. No. 1475. D.D.T. for Tobacco Warehouses and Store Rooms, by M. C. Mossop, M.Sc., Chief Entomologist.

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9-10/50. No. 1547. Tsetse Fly in Southern Rhodesia, 1949, by J. A. Whellan, B.Sc.

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7-8/44. No. 1269. Vermin and Notes on Methods of their Destruction, by the Vermin Conference Committee, assisted by E. Davison, Game Warden, Wankie Reserve.

7-8/45. No. 1313. Forestry Notes for Conservation Officers. Part I. The Relation of Forests to General Conservation and to Conditions in Southern Rhodesia, by E. J. Kelly-Edwards, Conservator of Forests.

9-10/45. No. 1320. Forestry Notes for Conservation Officers. Part II. Uses of Indigenous Forests, Wind Breaks, General Tree Planting, by E. J. Kelly-Edwards, Conservator of Forests.

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9-10/49. No. 1491. Raising and Planting of Trees on the Farm, by E. J. Kelly Edwards, M.A., Dip. For. (Oxon), Chief Conservator of Forests.

11-12/50. No. 1550. Price-Lists of Forest-Tree Transplants, Ornamental Trees and Shrubs, Hedge Plants, Creepers and Seeds.

9-10/50. No. 1544. Notes on Trees of Chirinda Forest, Mount Selinda, by R. B. Hack.

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7-8/47. No. 1408. Tung Nut Growing, by C. N. Hayter, F.Inst. P.A. (S.A.), Government Horticulturist.

7-8/48. No. 1448. Report on a Preliminary Reconnaissance of the Possibility of Cultivation of Tung Oil Trees in the Eastern Districts of S. Rhodesia, by C. C. Webster, Senior Agricultural Officer, Tung Experimental Station, Nyasaland, made at the request of the S.R.G. Natural Resources Board and Edited by C. N. Hayter, Horticulturist.

3-4/49. No. 1478. *Strawberry Growing, by C. N. Hayter, Horticulturist.

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11-12/50. No. 1554. Beetroot and Boron Deficiency, by C. N. Hayter.

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*Propagation of Plants, by C. N. Hayter, Horticulturist.

*The Home Orchard, by C. N. Hayter, Horticulturist.

*Vegetable Growing, by C. N. Hayter, Horticulturist.

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7-8/43. No. 1238. *A Reinforced Concrete Roof for Circular Reservoirs, by H. W. H. Wallis, B.Sc., Assoc.M.Inst.C.E., Assistant Irrigation Engineer.

7-8/46. No. 1358. Small Earthen Storage Dams, by the Irrigation Dept.

9-10/50. No. 1548. Some Notes on the Water Act as Amended 1949, by P. H. Haviland, B.Sc., M.I.C.E., Director of Irrigation.

11-12/50. No. 1551. Irrigation in America, by R. H. Roberts.

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5/36. No. 987. The Curing of Hides and Skins on the Farm, by The Division of Animal Husbandry.

1/37. No. 1012. Export of Frozen Porkers and Baconers. Fourth Consignment of Smithfield, by Division of Animal Husbandry.

4/37. No. 1023. Cowpea Molasses Silage for Fattening Steers, by C. A. Murray, M.Sc. (Agric.), Senior Animal Husbandry Officer in Charge, Matopo School of Agriculture and Experiment Station; A. E. Romyn, Ph.D., Chief Animal Husbandry Officer, Department of Agriculture, Salisbury; R. H. Fitt, Dipl. Agric., Animal Husbandry Officer, Department of Agriculture, Salisbury.

12/37. No. 1049. The Export of Frozen Porkers: Report on Five Consignments of Porkers Exported to Smithfield, by Division of Animal Husbandry.

11/38. No. 1091. Cost of Fattening Bullocks of various ages in Matabeleland, by A. E. Romyn and C. A. Murray.

1/42. No. 1192. Production of Rhodesia's Best Beef, by A. E. Romyn, Ph.D.

3-4/42. No. 1198. Soft Fat in Bacon Pigs, by C. A. Murray, Division of Animal Husbandry.

5-6/46. No. 1351. Feeding of Dairy Cows, by the Division of Animal Husbandry.

7-8/46. No. 1354. Winter Cereal Grazing for the Production of Fat Lambs—Press Service, Department of Agriculture, Pretoria.

7-8/47. No. 1403. *Sheep and Their Management in Southern Rhodesia, by C. A. Murray, Chief Animal Husbandry Officer.

11-12/47. No. 1428. *Cattle Bale or Grip, by B. G. Gundry, Agricultural Engineer.

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3-4/49. No. 1477. *The Raising of Bacon Pigs, by A. E. Romyn, Ph.D., C. A. Murray, M.Sc. (Agric.) and a Veterinary Section by D. A. Lawrence, B.V.Sc.

## METEOROLOGICAL.

12/24. No. 524. Use of an Aneroid Barometer, by C. L. Robertson, B.Sc., A.M.I.C.E.

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## PASTURES.

2/37. No. 1016. Natural Protection from Soil Erosion, by S. D. Timson, M.C., Assistant Agriculturist.

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1-2/47. No. 1384. Prelim. Results in Improving the Sandveld Vleis on the Grassland Experiment Station, Marandellas, by J. M. Rattray, Pasture Research Officer, and R. H. Fitt, Animal Husbandry Officer.

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3-4/48. No. 1439. Seasonal Growth and Changes in Chemical Composition of the Herbage on Marandellas Sandveld, by H. Weinmann, D.Sc., Pasture Research Chemist.

5-6/48. & 7-8/48. No. 1446. *Pasture Research in S. Rhodesia: Progress Report (1945-47), by the Division of Pasture Research.

11-12/48. No. 1461. Improved Dryland Pastures, by J. M. Rattray, M.Sc., Senior Pasture Research Officer, Grassland Experiment Station, Marandellas.

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11-12/50. No. 1557. Preliminary Report on a Comparison of Several Heavy Yielding Perennial Grasses for the Production of Ensilage, by T. C. D. Kenman, Pasture Research Officer.

## PLANT PATHOLOGY AND BOTANY.

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1/35. No. 942. Mycological Notes. Seasonal Notes on Tobacco Diseases. 8, The Mosaic Mystery. 9, Danger Points in Field Spraying, by J. C. F. Hopkins, D.Sc. (Lond.), A.I.C.T.A., Senior Plant Pathologist.

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## TOBACCO.

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## VETERINARY.

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1/28. No. 666. Notes from the Veterinary Laboratory: Praemonitus —Praemunitus, by Ll. E. W. Bevan, M.R.C.V.S., Director of Veterinary Research.

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## MISCELLANEOUS.

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5/31. No. 820. The Great Economic Problem in Agriculture—No. 1, by J. R. McLoughlin, M.Sc. (Economist), Economic Adviser.

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# Southern Rhodesia Veterinary Report

AUGUST, 1950.

**General.** With the exception of the Melsetter District the water position was serious with further deterioration in grazing. Cattle continued in fair condition.

**Tick Life.** Tick life was active in the Bulawayo and Gwelo Districts. The following quarantine notices were issued during the month: Salisbury 3, Bulawayo 2, Umtali 2.

## SCHEDULED DISEASES.

1. **African Coast Fever:** Nil.

2. **Theileriosis:** Five deaths occurred in the Salisbury District.

3. **Anthrax:** Inoculation continued in the Bulawayo District.

4. **Foot and Mouth Disease:** Staff seconded for duty in Bechuanaland returned to Southern Rhodesia. No further cases were reported in the Fort Victoria District.

5. **Glanders or Farcey:** Nil.

6. **Heartwater:** Nil.

7. **Lungsickness** (Contagious Pleuro Pneumonia of Cattle): Nil.

8. **Mange in Horses, Mules, Donkeys, and Camels:** Nil.

9. **Pyaemia or Epizootic Lymphangitis:** Nil.

10. **Piroplasmosis:** Confirmed on five farms in the Salisbury and Melsetter Districts and on four farms in the Umtali District.

11. **Rinderpest:** Nil.

12. **Swine Erysipelas:** Nil.

13. **Swine Fever:** Nil.

14. **Quarter Evil:** Cases were reported in all Districts, with several deaths.

15. **Tuberculosis:** Four cattle imported reacted positively to the test in the Bulawayo District. There were two positive reactors to the test in the Umtali District.

16. **Scab:** Nil.

17. **Rabies:** Suspicious reports in the Bulawayo District were investigated. Three cases were subsequently confirmed and a complete "stop order" has been placed on the Gwanda, Insiza, Matobo, Belingwe and Nuanetsi Districts and the Bulalima Mangwe District south of the railway line.

18. **Senkobo Disease:** Nil.

19. **Trypanosomiasis:** There were no further outbreaks in the Salisbury and Melsetter Districts. Block inoculation of all cattle in Urungwe Reserve is under way.

20. **Contagious Epididymitis and Vaginitis** (Epi-Vag): Two new centres were confirmed in the Salisbury District. The disease showed abatement in the Gwelo District.

21. **Lumpy Skin Disease:** Nil.

22. **Contagious Abortion:** Reported in the Bulawayo District.

## SCHEDULED POULTRY DISEASES.

23. **Spirochactosis:** Nil.

24. **Coccidiosis:** Four cases occurred in the Salisbury District.

25. **Fowl Typhoid:** Nil.

26. **Bacillary White Diarrhoea:** Nil.

27. **Tuberculosis:** Nil.

28. **Chicken Pox and Roup:** Two cases of Roup occurred in the Salisbury District.

## OTHER DISEASES.

29. **Gallsickness:** A few cases were reported in the Salisbury, Bulawayo and Melsetter Districts.

30. **Paratyphoid:** Nil.

31. **Horse Sickness:** Nil.

32. **Geilsieke:** Nil.

33. **Biliary:** Nil.

34. **Sweating Sickness:** Nil.

35. **Opthalmia:** Prevalent in the Fort Victoria District with a few cases in each of the remaining Districts.

36. **Screw Worm:** Increasing in the Bulawayo District with a few cases in the Salisbury, Umtali, Fort Victoria and Melsetter Districts.

37. **Coccidiosis:** Nil.

38. **Spirochactosis:** Nil.

39. **Internal Parasitis:** Heavy infestation on a ranch in the Bulawayo District. Very prevalent in the Melsetter District.

40. **Malignant Catarrhal Fever:** Three cases were reported in the Salisbury District.

## POISONING.

41. **Veld Poisoning:** Heavy losses were reported in the Gwelo District, with a few cases in the Salisbury and Melsetter District.

42. **Mineral Poisoning:** Cases were reported in the following Districts:—Arsenical: Salisbury 15, Bulawayo 1, Gwelo 5. Cyanide: Bulawayo 1, Gwelo 4.

**Mallein Testing:** 39 animals were tested with negative results.

**Tuberculin Testing:** 122 animals were tested with negative results.

## IMPORTATIONS.

**Union of South Africa:** Horses 51, Bulls 53, Cows and Calves 74 (breed), Goats 4 (Breed), and Pigs 2 (Breed).

## EXPORTATIONS.

**Portuguese East Africa:** 12 Oxen (Slgtr).

**Northern Rhodesia:** 1 Pig (Breed).

**Union of South Africa:** 9 Pigs (Breed).

## EXPORTATIONS—MISCELLANEOUS.

**Union of South Africa:** 12,623 lbs. Sausage Casings.

**Northern Rhodesia:** 8,817 lbs. ¾ Sides, 5,772 lbs. Middles, 85 Rolls, 1,001 lbs. Hams, 1,487 lbs. Gammon, 3,110 lbs. Cooked Shoulder, 1,629 lbs. Sliced Shoulder, 4,466 lbs. Smalls.

**Belgian Congo:** 417 lbs. Graded Porkers, 96 lbs. Hams, 1,050 lbs. Gammon, 642 lbs. Sausage Casings, 118,650 lbs. ¼'s Beef, 27,301 lbs. Offals and Smalls.

**Bechuanaland Protectorate:** 43 lbs. Middles, 63 lbs. Cooked Shoulder, 159 lbs. Sliced Shoulder, 480 lbs. Smalls.

**Meat Products from Liebigs (Rhodesia) Ltd., West Nicholson:—**

**Belgian Congo:** 13,272 lbs. Corned Beef, 60 lbs. Vienna Sausages, 24 lbs. Curried Beef.

**Union of South Africa:** 32,031 lbs. Potted Meat.

**Portuguese East Africa:** 225 lbs. Vienna Sausages.

J. S. ADAMSON,
Director of Veterinary Services.

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**Treated: Standard Charges for Fencing Poles.**

| Specification | | Price | Approx. Weight |
|---|---|---|---|
| Straining Posts | 8′ 5″—6″ tips | 5/6 each | 100 lbs. each |
| Fence Posts | 6½′ 3″—5″ ,, | 3/0 each | 50 lbs. each |
| Droppers | 5′ 1″—1½″ ,, | 30/0 per 100 | 900 lbs. per 100 |
| Droppers | 3½′ 1″—1½″ ,, | 20/0 per 100 | 400 lbs. per 100 |

# Rhodesian Milk Records

## OFFICIAL MILK RECORDS.

| *Name of Cow.* | *Breed.* | *Age.* | *Milk in lbs.* | *B. Fat in lbs.* | *Average % B. Fat.* | *No. of Days.* | *Name and Address of Owner.* |
|---|---|---|---|---|---|---|---|
| Schoongezicht Lonely | Jersey | Jun. 4 years | 5383.00 | 251.22 | 4.67 | 300 | M. W. Burras, Hertford Farm, Box 443, Bulawayo. |
| Vrederust Red-wing | Jersey | Mature | 6528.00 | 332.59 | 5.09 | 300 | |
| Dalham Rosaline | Jersey | Sen. 4 years | 7005.00 | 381.83 | 5.45 | 300 | S. Gelman, 27, Baxendale St., Bulawayo. |
| Dalham Theresa | Jersey | Mature | 7003.50 | 351.88 | 5.02 | 300 | |
| Matopo Utopia | Red Poll | Mature | 9280.30 | 323.59 | 3.50 | 292 | Government Experiment Station, P.B. 19K, Bulawayo. |
| Matopo Vera | Red Poll | Sen. 4 years | 7387.00 | 301.62 | 4.08 | 295 | |
| Matopo Wanda | Red Poll | Sen. 4 years | 6829.80 | 254.42 | 3.73 | 288 | |
| *Criterion Jantje I | Friesland | Jun. 3 years | 10744.00 | 317.05 | 2.95 | 300 | J. Jamieson, Box 217, Bulawayo. |
| *Criterion Spinne-kop IX | Friesland | 2 years | 9861.00 | 341.39 | 3.46 | 300 | |
| Katinka Nancy | Jersey | Sen. 4 years | 4865.50 | 230.77 | 4.74 | 300 | J. H. Keightley, Moorfields, Glendale. |
| Leachdale Bac-trina | Friesland | Mature | 7522.00 | 263.06 | 3.50 | 300 | Meikles Trust & Invest. Co., Ltd., Leachdale Farm, Shangani. |
| Leachdale Elone | Friesland | Mature | 3216.00 | 124.05 | 3.86 | 267 | |
| Mitchlin April's Angela | Friesland | Jun. 3 years | 6864.00 | 237.38 | 3.46 | 300 | D. Robertson Synd., Ltd., Hilda's Kraal, P.B. 158R, Bulawayo. |
| Mitchlin Lobelia's Celeste | Friesland | Sen. 3 years | 7035.00 | 233.23 | 3.32 | 300 | |

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|---|---|---|---|---|---|---|---|
| Whinburn Alchemy | Friesland | Mature | 8343.20 | 306.29 | 3.67 | 294 | Major R. R. Sharp, Whinburn, Redbank, Bulawayo. |
| *Whinburn Artful | Friesland | Mature | 13485.20 | 501.02 | 3.72 | 300 | |
| Whinburn Balm | Friesland | Mature | 9119.10 | 336.03 | 3.68 | 300 | |
| Whinburn Elfin | Friesland | 2 years | 8601.50 | 297.63 | 3.48 | 300 | |
| Whinburn Emblem | Friesland | 2 years | 5966.60 | 205 86 | 3.45 | 300 | |
| *Whinburn Sage | Friesland | Mature | 13485.80 | 460.87 | 3.42 | 300 | |

* Denotes cows milked three times daily.

## SEMI-OFFICIAL MILK RECORDS

| *Name of Cow.* | *Breed.* | *Age.* | *Milk in lbs.* | *B. Fat in lbs.* | *Average % B. Fat.* | *No. of Days.* | *Name and Address of Owner.* |
|---|---|---|---|---|---|---|---|
| Drieklip Rietvlei | P.B. Jersey | 2 years | 5161.40 | 248.51 | 4.81 | 300 | Lord Acton, M'bebi, Mazoe. |
| Groot Lorette | P.B. Jersey | 3 years | 4939.60 | 233.24 | 4.72 | 300 | |
| Maureen | G. Friesland | Mature | 7415.60 | 252.39 | 3.40 | 300 | N. G. Barrett, Gavenny, P.O. Box 38, Rusape. |
| Melda | G. Friesland | Mature | 6002.30 | 236.55 | 3.94 | 300 | |
| Dolly | G. Shorthorn | Mature | 9765.50 | 404.15 | 4.14 | 300 | F. J. Barry, Box 209, Umtali. |
| Grand Reef | G. Friesland | Mature | 6909.00 | 248.32 | 3.59 | 300 | |
| Molly II | G. Shorthorn | Mature | 6375.00 | 249.75 | 3.92 | 300 | |
| Queen IV | G. Shorthorn | 3 years | 7212.50 | 262.72 | 3.64 | 300 | |
| Quizzie | G. Afrikander | Mature | 4758.50 | 227.54 | 4.78 | 213 | |
| Joyful | G. Shorthorn | Mature | 5319.10 | 231.46 | 4.35 | 300 | J. H. Barry, Box 209, Umtali. |
| Albert Vale Bokwagen | P.B. Friesland | Mature | 8236.30 | 292.16 | 3.55 | 292 | J. A. Baxter, Glen Norah, Box 1368, Salisbury. |
| Albert Vale Lena XVII | P.B. Friesland | Mature | 9032.50 | 280.17 | 3.10 | 300 | |
| Albert Vale Umpoekoe IX | P.B. Friesland | Mature | 10769.80 | 349.28 | 3.24 | 300 | |
| Barbara | G. Friesland | 3 years | 6001.10 | 226.05 | 3.77 | 300 | R. R. Bennett, P.O. Box 164, Umtali. |
| Jean | G. Friesland | 2 years | 6015.10 | 227.48 | 3.78 | 300 | |
| Razor | G. Friesland | Mature | 6268.00 | 261.02 | 4.16 | 271 | A. Berry, Lendy, P.O. Marandellas. |
| Fanny | G. Friesland | 2 years | 6476.00 | 260.69 | 4.03 | 300 | |
| Juno | G. Friesland | 2 years | 5340.00 | 237.89 | 4.46 | 297 | |
| Makuta | G. Friesland | Mature | 10245.00 | 333.99 | 3.25 | 300 | |
| Dirko May XI | P.B. Friesland | 3 years | 7293.00 | 238.32 | 3.27 | 300 | A. L. Bickle, Box 595, Bulawayo. |
| Dirko Roland's Maandag | P.B. Friesland | 3 years | 6982.70 | 268.76 | 3.85 | 300 | |
| D. 71 | G. Friesland | Mature | 10535.70 | 341.12 | 3.22 | 300 | |
| D. 73 | G. Friesland | Mature | 11612.80 | 378.50 | 3.26 | 300 | |
| D. 97 | G. Friesland | Mature | 9780.50 | 320.74 | 3.28 | 300 | |
| D. 120 | G. Friesland | Mature | 7403.40 | 230.68 | 3.12 | 300 | |
| D. 149 | G. Friesland | Mature | 9203.50 | 314.41 | 3.42 | 273 | |
| D. 222 | G. Friesland | 4 years | 6988.10 | 236.74 | 3.39 | 300 | |

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|---|---|---|---|---|---|---|---|
| Destiny IV | G. Friesland | Mature | 7401.50 | 233.81 | 3.16 | 288 | Mrs. M. Black, Burnside, P.O. Bindura. |
| Marty II | G. Friesland | Mature | 6494.50 | 229.98 | 3.54 | 300 | |
| Blackie | G. Common | Mature | 6756.00 | 268.44 | 3.94 | 300 | J. P. Bonnett, P.O. Box 622, Bulawayo. |
| Dirko Jessie | P.B. Friesland | Mature | 9319.00 | 315.93 | 3.39 | 300 | C. Boyd Clark, Mount Zonga, Inyazura. |
| Signora IV | G. Friesland | Mature | 6415.00 | 245.75 | 3.83 | 278 | |
| Truant IV | G. Friesland | Mature | 9418.00 | 296.77 | 3.15 | 300 | |
| Zonga Jess II | P.B. Friesland | 4 years | 8566.00 | 328.69 | 3.84 | 300 | |
| No. 287 | G. Friesland | Mature | 6770.00 | 249.18 | 3.68 | 300 | |
| No. 319 | G. Friesland | Mature | 7616.00 | 278.59 | 3.66 | 300 | |
| No. 402 | G. Friesland | 3 years | 6455.00 | 226.66 | 3.51 | 300 | |
| No. 404 | G. Friesland | 3 years | 5916.00 | 228.16 | 3.85 | 281 | |
| No. 409 | G. Friesland | 3 years | 6467.00 | 245.06 | 3.79 | 300 | |
| Grove Park Ann | G. Friesland | Mature | 7906.00 | 245.92 | 3.11 | 300 | Bradley Bros., P.O. Box 699, Bulawayo. |
| Grove Park Lily | G. Friesland | 4 years | 7993.00 | 261.44 | 3.27 | 300 | |
| Jess | G. Friesland | Mature | 7473.00 | 252.90 | 3.38 | 300 | Miss N. Brereton, Coolmoreen, Gwelo. |
| Netty | G. Guernsey | 2 years | 5940.00 | 228.18 | 3.84 | 283 | |
| Chummy | G. Friesland | 3 years | 6713.00 | 267.91 | 3.99 | 300 | B.S.A. Co. Mazoe Citrus Estate, Mazoe. |
| Rhodesia | G. Friesland | 3 years | 9219.00 | 298.77 | 3.24 | 300 | |
| White II | G. Friesland | Mature | 15787.00 | 523.84 | 3.33 | 365 | |
| No. 22 | G. Friesland | 4 years | 6326.70 | 258.50 | 4.09 | 300 | Col. P. A. Brooke, "Borrowdale-Homestead," P.O. Box 1690, Salisbury. |
| Sunshine | G. Friesland | Mature | 8839.00 | 295.59 | 3.34 | 300 | M. W. Burras, Box 443, Bulawayo. |
| Emily | G. Friesland | Mature | 9138.00 | 308.45 | 3.38 | 300 | L. E. O. Cary, "Clovelly," Trelawney. |
| Janet | G. Ayrshire | Mature | 6400.50 | 261.01 | 4.08 | 300 | |
| Primula | G. Ayrshire | Mature | 6537.50 | 234.75 | 3.59 | 300 | |
| Ruth | G. Ayrshire | Mature | 8100.50 | 281.55 | 3.48 | 300 | |
| Daisy | G. Friesland | 3 years | 5588.00 | 261.87 | 4.69 | 250 | J. R. Clark, Magaragada, Headlands. |
| Shamrock | G. Friesland | Mature | 7446.00 | 264.21 | 3.55 | 300 | T. Cousins, P.B. 20, Gwelo. |

**SEMI-OFFICIAL**—(Continued)

| *Name of Cow.* | *Breed.* | *Age.* | *Milk in lbs.* | *B. Fat in lbs.* | *Average % B. Fat.* | *No. of Days.* | *Name and Address of Owner.* |
|---|---|---|---|---|---|---|---|
| No. 27 | G. Friesland | Mature | 7431.00 | 239.89 | 3.09 | 300 | Cross & Son, P.B. T.208, Bulawayo. |
| No. 35 | G. Friesland | Mature | 9986.00 | 325.36 | 3.26 | 300 | |
| No. 57 | G. Friesland | Mature | 7847.00 | 249.33 | 3.18 | 300 | |
| No. 91 | G. Friesland | Mature | 7234.00 | 268.63 | 3.71 | 300 | |
| No. 94 | G. Friesland | Mature | 7441.00 | 236.68 | 3.18 | 286 | |
| No. 97 | G. Friesland | Mature | 6975.00 | 250.51 | 3.59 | 261 | |
| No. 115 | G. Friesland | 3 years | 6339.00 | 228.62 | 3.61 | 300 | |
| Bioscope | G. Friesland | Mature | 6130.80 | 225.54 | 3.68 | 300 | A. B. Dobson, Endeavour Farm, Norton. |
| Violet | G. Friesland | Mature | 6848.40 | 230.35 | 3.36 | 300 | |
| Mazoe | G. Friesland | Mature | 7618.90 | 305.84 | 4.01 | 281 | J. N. Duff, Box 3, Marandellas. |
| Sarah | G. Friesland | 4 years | 7176.10 | 247.64 | 3.45 | 300 | |
| Swan | G. Friesland | Mature | 7655.90 | 322.72 | 4.22 | 297 | |
| Queen Mary | G. Friesland | Mature | 6608.00 | 280.77 | 4.25 | 300 | R. I. Edwards, Box 25, Chipinga. |
| Betty I | G. Red Poll | Mature | 5225.00 | 229.71 | 4.40 | 281 | H. J. Elliott, P.O. Box 285, Umtali. |
| Betty II | G. Friesland | Mature | 7121.00 | 248.57 | 3.38 | 294 | |
| Zabron | G. Friesland | Mature | 6277.00 | 251.36 | 4.02 | 232 | |
| Zonga De Grendel Elsa | P.B. Friesland | Mature | 8466.00 | 302.10 | 3.57 | 300 | Mrs. M. Everard, Castle Zonga, Inyazura. |
| Zonga Queen III | P.B. Friesland | Mature | 6556.00 | 286.94 | 4.38 | 300 | |
| Zonga Queen VIII | P.B. Friesland | Mature | 6593.00 | 248.99 | 3.78 | 300 | |
| No. 153 | G. Friesland | Mature | 6252.00 | 234.61 | 3.75 | 300 | |
| No. 164 | G. Friesland | Mature | 6428.00 | 301.48 | 4.69 | 300 | |
| No. 169 | G. Friesland | Mature | 7883.00 | 283.71 | 3.60 | 277 | |
| No. 316 | G. Friesland | Mature | 6841.00 | 264.82 | 3.87 | 300 | |
| No. 318 | G. Friesland | Mature | 7807.00 | 260.69 | 3.34 | 300 | |
| No. 334 | G. Friesland | 4 years | 6642.00 | 229.85 | 3.46 | 287 | |
| No. 376 | G. Friesland | Mature | 7838.00 | 297.74 | 3.80 | 300 | |
| No. 9 | G. Friesland | 3 years | 9545.00 | 372.64 | 3.90 | 300 | Mrs. H. C. Fischer, Olivia Farm, Headlands. |
| No. 13 | G. Friesland | 3 years | 9511.50 | 239.21 | 3.56 | 300 | |
| No. 28 | G. Friesland | 2 years | 9057.50 | 310.12 | 3.42 | 300 | |
| No. 33 | G. Friesland | Mature | 8596.50 | 316.46 | 3.68 | 300 | |
| No. 135 | G. Friesland | Mature | 10709.00 | 386.71 | 3.61 | 300 | |
| No. 151 | G. Friesland | 4 years | 8631.00 | 311.59 | 3.61 | 300 | |
| No. 292 | G. Friesland | Mature | 9931.00 | 400.43 | 4.03 | 300 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. 245 | G. Friesland | 4 years | 6943.00 | 253.84 | 3.66 | 300 | R. Le S. Fischer, Wakefield, P.O. Headlands. |
| No. 42A | G. Friesland | 4 years | 5808.00 | 233.97 | 4.03 | 300 | W. F. Fischer, Coldstream Dairy, Headlands. |
| No. 62A | G. Friesland | 3 years | 5793.00 | 245.12 | 4.23 | 300 | |
| No. 68A | G. Friesland | 3 years | 5977.00 | 225.98 | 3.78 | 300 | |
| No 70A | G. Friesland | 3 years | 5676.00 | 238 71 | 4.21 | 300 | |
| No. 71A | G. Friesland | 3 years | 6859.00 | 237.31 | 3.56 | 300 | |
| No. 79A | G. Friesland | 2 years | 5421 00 | 229.49 | 4 23 | 300 | |
| No. 405 | G. Friesland | Mature | 7933.00 | 257.33 | 3.21 | 300 | |
| No. 449 | G. Friesland | Mature | 5477.00 | 263.80 | 4.82 | 300 | |
| No. 454 | G. Friesland | Mature | 6379.00 | 226.47 | 3.55 | 300 | |
| No. 495 | G. Friesland | Mature | 9453.00 | 344.76 | 3.65 | 300 | |
| No. 499 | G. Friesland | Mature | 6355.00 | 276.13 | 4.35 | 300 | |
| No. 500 | G. Friesland | Mature | 7347.00 | 244.04 | 3.32 | 300 | |
| No. 502 | G. Friesland | Mature | 7698.00 | 282.91 | 3.68 | 300 | |
| No. 512 | G. Friesland | Mature | 6706.00 | 237.17 | 3.53 | 300 | |
| No. 533 | G. Friesland | Mature | 8743.00 | 282.75 | 3.23 | 300 | |
| No. 549 | G. Friesland | Mature | 10715.00 | 343.23 | 3.20 | 300 | |
| No. 569 | G. Friesland | Mature | 7981 00 | 296.95 | 3.72 | 300 | |
| No. 598 | G. Friesland | 4 years | 7506.00 | 305.51 | 4.07 | 300 | |
| April | G. Friesland | 3 years | 7499.40 | 295.90 | 3.46 | 300 | G. J. Franklin & Son, Box 105, Umtali. |
| Augusta | G. Friesland | 2 years | 6563.00 | 261 08 | 3.98 | 300 | |
| Beulah | G. Friesland | Mature | 8755.70 | 323.33 | 3.69 | 269 | |
| Blackie | G. Friesland | 2 years | 6263 20 | 260.00 | 4.14 | 300 | |
| Brindle II | G. Guernsey | 4 years | 9923.20 | 424.52 | 4.28 | 300 | |
| Bubbles | G. Friesland | Mature | 9025.30 | 322.91 | 3.58 | 300 | |
| Bulbul | G. Friesland | Mature | 7487.30 | 301.94 | 4.03 | 300 | |
| Chipinga | G. Friesland | 2 years | 5107.10 | 226.39 | 4.43 | 299 | |
| Cigarette | G. Friesland | 4 years | 10725.00 | 387.90 | 3.62 | 300 | |
| Daisy | G. Friesland | Mature | 11022.60 | 423.71 | 3.84 | 300 | |
| David | G. Friesland | Mature | 7879.90 | 283.59 | 3.60 | 290 | |
| Fern | G. Friesland | Mature | 9724.30 | 434.43 | 4.47 | 300 | |
| Friday | G. Friesland | 2 years | 5750.10 | 252.06 | 4.38 | 289 | |
| Ganganda I | G. Guernsey | Mature | 5949.90 | 287.09 | 4.83 | 260 | |
| Ganganda III | G. Friesland | Mature | 7881.50 | 356.07 | 4.52 | 263 | |
| Gin | G. Friesland | Mature | 8468 70 | 271.76 | 3.21 | 300 | |
| Ginger | G. Friesland | 2 years | 8168.60 | 284.42 | 3.48 | 300 | |
| Ginger Beer | G. Friesland | 4 years | 11380.20 | 454.73 | 4.00 | 300 | |
| Headlands | G. Friesland | 2 years | 8146.50 | 296.94 | 3.65 | 300 | |
| Hospital | G. Friesland | 2 years | 7699.00 | 325.37 | 4.23 | 300 | |
| Juliet | G. Friesland | 4 years | 6244.90 | 277.21 | 4.44 | 291 | |

**SEMI-OFFICIAL**—(Continued).

| *Name of Cow.* | *Breed.* | *Age.* | *Milk in lbs.* | *B. Fat in lbs.* | *Average % B. Fat.* | *No. of Days.* | *Name and Address of Owner.* |
|---|---|---|---|---|---|---|---|
| Katherine | G. Guernsey | 4 years | 7883.80 | 336.24 | 4.27 | 300 | G. J. Franklin & Son, Box 105, Umtali. |
| Macequece | G. Friesland | Mature | 7840.50 | 313.11 | 3.99 | 300 | |
| Madeline | G. Friesland | Mature | 11114.9 | 357.97 | 3.22 | 298 | |
| Maggie | G. Friesland | Mature | 7364.70 | 292.13 | 3.95 | 271 | |
| Marandellas | G. Friesland | 4 years | 8924.80 | 362.15 | 4.06 | 300 | |
| Mhaka II | G. Friesland | Mature | 5843.60 | 248.82 | 4.26 | 279 | |
| Miranda | G. Friesland | 4 years | 10512.10 | 442.22 | 4.21 | 300 | |
| M'sorro | G. Friesland | Mature | 8106.70 | 312.12 | 3.85 | 260 | |
| Nancy | G. Friesland | Mature | 6454.10 | 301.94 | 4.66 | 277 | |
| Nanny | G. Friesland | Mature | 8086.00 | 328.89 | 4.07 | 277 | |
| November | G. Friesland | 4 years | 5883.70 | 243.02 | 4.13 | 300 | |
| Nutmeg | G. Friesland | Mature | 13332.70 | 495.75 | 3.72 | 300 | |
| Patsy | G. Shorthorn | Mature | 7873.10 | 358.26 | 4.55 | 300 | |
| Pauline | G. Friesland | Mature | 8544.30 | 351.45 | 4.12 | 300 | |
| Phoebe's Jean | G. Friesland | Mature | 11180.50 | 436.65 | 3.91 | 300 | |
| Picanin | G. Friesland | 4 years | 12149.10 | 453.84 | 3.74 | 300 | |
| Rhoda | G. Friesland | 2 years | 7271.00 | 310.67 | 4.27 | 300 | |
| Rodie II | G. Friesland | 4 years | 5494.00 | 238.18 | 4.34 | 300 | |
| Sandra | G. Friesland | 3 years | 5799.50 | 247.35 | 4.27 | 286 | |
| Senara II | G. Guernsey | Mature | 7045.70 | 299.46 | 4.25 | 300 | |
| Socks II | G. Friesland | Mature | 8214.70 | 338.79 | 4.12 | 253 | |
| Sophie | G. Friesland | 4 years | 7456.40 | 234.08 | 3.14 | 286 | |
| Spitfire | G. Friesland | Mature | 7556.70 | 245.76 | 3.25 | 261 | |
| Suund | G. Shorthorn | Mature | 9627.30 | 390.96 | 4.06 | 300 | |
| Tinker | G. Friesland | Mature | 4211.40 | 233.69 | 5.55 | 275 | |
| Victoria | G. Friesland | 2 years | 7536.90 | 325.53 | 4.32 | 300 | |
| Watsomba | G. Guernsey | 2 years | 7062.70 | 331.82 | 4.70 | 300 | |
| White II | G. Afrikander | Mature | 7681.10 | 340.97 | 4.44 | 300 | |
| Xmas | G. Friesland | Mature | 6430.90 | 286.08 | 4.45 | 300 | |
| No. 64 | G. Friesland | 3 years | 5781.60 | 225.94 | 3.91 | 300 | P. Freeland, Lingfield, Gwelo. |
| Whinburn Gavotte | P.B. Friesland | Mature | 8409.50 | 285.21 | 3.39 | 300 | G. G. Futter, Marjoribanks, P.O. Gwelo. |
| Ghenna | G. Friesland | 4 years | 7776.80 | 296.59 | 3.81 | 300 | R. J. Garvin, "Fairview," Umtali. |

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|---|---|---|---|---|---|---|---|
| No. 35 | G. Friesland | Mature | 9326.50 | 323.81 | 3.47 | 300 | S. Gelman, 27, Baxendale Street, Bulawayo. |
| Amy | G. Friesland | 4 years | 7988.00 | 281.76 | 3.53 | 300 | Hon. H. V. Gibbs, P.B. 52L, Bulawayo. |
| Blackie | G. Friesland | 4 years | 7913.00 | 318.87 | 4.03 | 300 | |
| Colleen | G. Friesland | 4 years | 6713.00 | 289.07 | 4.31 | 300 | |
| Glossy | G. Friesland | 4 years | 7357.00 | 251.25 | 3.42 | 300 | |
| Ribbon | G. Friesland | 3 years | 10832.00 | 335.30 | 3.10 | 300 | |
| Snowball | G. Friesland | 3 years | 7336.00 | 237.93 | 3.38 | 300 | |
| Sue | G. Friesland | 4 years | 8476.00 | 262.85 | 3.10 | 300 | |
| Gilda | G. Friesland | 3 years | 5405.00 | 239.58 | 4.43 | 300 | R. Gordon Lennox, "Rakodzi," Marandellas. |
| Jewel | G. Friesland | Mature | 9321.00 | 318.95 | 3.42 | 300 | Government Demonstration Farm, Umshandige, Fort Victoria. |
| June | G. Friesland | 4 years | 8597.50 | 310.71 | 3.61 | 300 | |
| Patches | G. Friesland | Mature | 10403.00 | 393.80 | 3.79 | 300 | |
| Barlow's Vergelegen Marina | P.B. Jersey | 3 years | 5687.00 | 372.36 | 6.55 | 300 | Government Demonstration Farm, Karoi |
| Barlow's Vergelegen Redwing's Diamond | P.B. Jersey | 3 years | 5491.50 | 277.42 | 5.05 | 300 | |
| No. 23 | G. Friesland | Mature | 12207.50 | 418.69 | 3.43 | 300 | Grasslands Experiment Stn., Marandellas |
| No. 94 | G. Friesland | 4 years | 10648.50 | 367.04 | 3.45 | 300 | |
| Greta | G. Guernsey | 3 years | 5145.40 | 250.94 | 4.88 | 300 | D. A. Harley, Harleyton, P.O. Beatrice. |
| Isobel | G. Guernsey | 4 years | 5709.40 | 264.50 | 4.63 | 300 | |
| Olga | G. Guernsey | 4 years | 5040.00 | 249.50 | 4.95 | 294 | |
| Kathleen | G. Guernsey | Mature | 5205.90 | 247.32 | 4.75 | 300 | |
| Joan | G. Friesland | 3 years | 7299.00 | 227.97 | 3.12 | 300 | D. J. Huddy, Box 718, Salisbury. |
| Kay | G. Friesland | 4 years | 9492.50 | 321.41 | 3.39 | 300 | |
| Kitty | G. Friesland | Mature | 6719.00 | 267.55 | 3.98 | 296 | |
| Olga | G. Friesland | Mature | 9824.50 | 347.09 | 3.64 | 265 | |
| Peggy | G. Friesland | 4 years | 6658.50 | 236.25 | 3.55 | 248 | |
| Rosemary | G. Friesland | Mature | 6592.00 | 241.57 | 3.66 | 244 | |
| Vixen | G. Friesland | Mature | 7003.00 | 258.52 | 3.69 | 300 | |
| Winkie | G. Friesland | 3 years | 6796.50 | 238.80 | 3.52 | 279 | |
| Clover | G. Friesland | Mature | 8330.80 | 297.46 | 3.57 | 300 | L. Huddy, Box 924, Salisbury. |
| Helen | G. Friesland | 4 years | 5972.40 | 235.83 | 3.95 | 300 | |
| Joan | G. Friesland | 4 years | 6196.90 | 240.70 | 3.88 | 300 | |
| Pixie | G. Guernsey | Mature | 6295.80 | 226.24 | 3.59 | 297 | |

**SEMI-OFFICIAL**—(Continued).

| *Name of Cow.* | *Breed.* | *Age.* | *Milk in lbs.* | *B. Fat in lbs.* | *Average % B. Fat.* | *No. of Days.* | *Name and Address of Owner.* |
|---|---|---|---|---|---|---|---|
| Annie | G. Guernsey | Mature | 5077.00 | 244.38 | 4.81 | 249 | Mrs. M. R. Huddy, P.O. Box 899, Salisbury |
| Betty | G. Friesland | Mature | 7285.00 | 262.16 | 3.60 | 300 | J. A. G. Hughes, Bains Hope, P.O. Melfort. |
| Royal | G. Ayrshire | Mature | 7734.00 | 290.41 | 3.73 | 300 | |
| Statice | G. Jersey | Mature | 4549.00 | 236.94 | 5.21 | 300 | |
| Suzanne | G. Friesland | Mature | 7233.00 | 253.04 | 3.50 | 300 | |
| J. 56/2/1 | G. Friesland | 4 years | 9242.00 | 296.18 | 3.20 | 300 | J. Jamieson, Box 217, Bulawayo. |
| J. 105/1 | G. Friesland | 3 years | 11240.00 | 381.66 | 3.40 | 300 | |
| No. 6 | G. Friesland | Mature | 10055.00 | 357.84 | 3.56 | 300 | D. S. Kabot, Box 261, Bulawayo. |
| No. 17 | G. Friesland | Mature | 9174.00 | 309.87 | 3.38 | 300 | |
| No. 25A | G. Friesland | 4 years | 11909.00 | 384.32 | 3.23 | 300 | |
| No. 34 | G. Friesland | Mature | 9010.00 | 332.58 | 3.69 | 300 | |
| No. 39A | G. Friesland | 4 years | 9814.00 | 328.28 | 3.55 | 300 | |
| No. 40A | G. Friesland | 2 years | 5817.00 | 226.60 | 3.90 | 300 | |
| No. 41 | G. Friesland | Mature | 7657.00 | 230.60 | 3.01 | 300 | |
| No. 51A | G. Friesland | 3 years | 9150.00 | 309.01 | 3.56 | 300 | |
| No. 60A | G. Friesland | 2 years | 8293.00 | 266.53 | 3.21 | 300 | |
| No. 85 | G. Friesland | Mature | 9251.00 | 312.15 | 3.37 | 300 | |
| D. 14 | G. Friesland | Mature | 8152.50 | 260.88 | 3.20 | 300 | B. H. Kew, Box 972, Bulawayo. |
| K. 2 | G. Friesland | Mature | 8088.60 | 320.90 | 3.97 | 300 | |
| K. 25 | G. Friesland | Mature | 6488.10 | 226.94 | 3.50 | 300 | |
| K. 28 | G. Friesland | Mature | 11424.30 | 360.89 | 3.16 | 300 | |
| K. 42 | G. Friesland | 4 years | 8028.80 | 247.69 | 3.09 | 300 | |
| Bauhinia | G. Friesland | Mature | 8758.00 | 321.78 | 3.67 | 277 | D. King, Rockwood Farm, Concession. |
| Pickles | G. Friesland | 4 years | 8347.00 | 309.96 | 3.71 | 300 | |
| Zinnia | G. Friesland | Mature | 6043.00 | 257.59 | 4.26 | 270 | |
| Kingston Bandie | G. Friesland | Mature | 8039.00 | 268.59 | 3.34 | 300 | Kingston Farm Syndicate, Box 2, Bindura. |
| Kingston Nipper | G. Friesland | Mature | 8653.00 | 327.58 | 3.79 | 300 | |
| Kingston Odol | G. Friesland | Mature | 6779.00 | 228.77 | 3.37 | 292 | |
| Kingston Option | G. Friesland | Mature | 6702.00 | 271.10 | 4.05 | 300 | |
| Kingston Town | G. Friesland | Mature | 6512.00 | 226.27 | 3.47 | 300 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rosandra | G. Friesland | 4 years | 7051.80 | 235.83 | 3.34 | 300 | Mrs. M. M. Krahner, Haydock Park Banket. |
| No. 36 | G. Friesland | Mature | 7115.30 | 264 14 | 3.71 | 300 | H. T. Lay, P.B. 107C, Salisbury. |
| Larkhill Eve | G. Friesland | 2 years | 5201.50 | 226 05 | 4.35 | 300 | J. N. L. MacIlwaine, Box 23, Marandellas. |
| Madge | G. Friesland | Mature | 7073.50 | 244 57 | 3.46 | 278 | |
| Whinburn Bubble | P.B. Friesland | 4 years | 7714.00 | 252.17 | 3.27 | 300 | |
| Zonga Queen VI | P.B. Friesland | 4 years | 6746.50 | 254.36 | 3.77 | 300 | |
| Kofman | G. Friesland | Mature | 7648.00 | 263.74 | 3.45 | 300 | J. MacIntyre, Box 58, Shamva. |
| Petal | P.B. Friesland | 3 years | 6882.0 | 243.14 | 3.53 | 300 | |
| Flerrie | G. Friesland | 4 years | 7345.30 | 272.05 | 3.70 | 285 | D. W. Marshall, Alderbury, Box 164, Umtali. |
| Ida | G. Friesland | Mature | 6767.90 | 244.91 | 3.62 | 300 | |
| Lucy | G. Friesland | 4 years | 6055.30 | 234.61 | 3.87 | 278 | |
| Makwin | G. Jersey | Mature | 4836.20 | 266.22 | 5.50 | 300 | Lt.-Col. C. I. F. Maynard, Melfort, P.B. 112C, Salisbury. |
| No. 43 | G. Friesland | Mature | 7751.00 | 244.76 | 3.16 | 300 | J. U. McCay, P.B. J181, Bulawayo. |
| No. 50 | G. Friesland | Mature | 7948.00 | 283 89 | 3.57 | 300 | |
| No. 75 | G. Friesland | Mature | 6389.00 | 236.00 | 3.69 | 300 | |
| No. 116 | G. Friesland | Mature | 8270.00 | 272.50 | 3.30 | 300 | |
| No. 128 | G. Friesland | Mature | 7275.00 | 256.15 | 3.52 | 300 | |
| No. 153 | G. Friesland | 4 years | 7412.00 | 232.08 | 3.13 | 300 | |
| Thabet Park Lindberg Zanna | P.B. Friesland | Mature | 7671.00 | 260.31 | 3.39 | 300 | |
| No. 10 | G. Guernsey | Mature | 7620.10 | 325 94 | 4.28 | 300 | J. H. McLean, Box 161, Gwelo. |
| No. 24 | G. Friesland | Mature | 6466.50 | 229 67 | 3.55 | 300 | |
| Fork | G. Friesland | Mature | 8337.70 | 346.77 | 4.16 | 300 | |
| Stowe | G. Friesland | Mature | 7279.40 | 278.13 | 3.82 | 299 | |
| Surprise | G. Guernsey | 3 years | 5464.10 | 225 91 | 4.11 | 300 | |
| Wanderer | G. Friesland | 3 years | 7645.20 | 266.82 | 3.49 | 300 | |
| No. 2/8 | P.B. Friesland | Mature | 7393.00 | 225.04 | 3.04 | 300 | Meikles Trust & Invest. Co., Ltd., Leachdale Farm, Shangani. |
| No. G. 49/3 | G. Friesland | Mature | 11373.00 | 371.11 | 3.26 | 300 | |
| Charlotte | G. Ayrshire | 4 years | 8522.00 | 301.76 | 3.54 | 300 | R. L. Moffat, Ormiston, Shangani. |
| Circe II | G. Ayrshire | 3 years | 6444.00 | 253.88 | 3.92 | 300 | |
| Daphne | G. Ayrshire | Mature | 7861.00 | 352.01 | 4.48 | 300 | |
| Helen I | G. Ayrshire | Mature | 6282.00 | 227.35 | 3.62 | 280 | |

**SEMI-OFFICIAL**—(Continued).

| *Name of Cow.* | *Breed.* | *Age.* | *Milk in lbs.* | *B. Fat in lbs.* | *Average % B. Fat.* | *No. of Days.* | *Name and Address of Owner.* |
|---|---|---|---|---|---|---|---|
| Warspite | G. Ayrshire | 3 years | 6036.00 | 356.96 | 4.26 | 300 | Commander E. L. Morant, Box 741, Salisbury. |
| Wedza | G. Ayrshire | 3 years | 5670.00 | 268.89 | 4.74 | 300 | |
| Whitehorn | G. Ayrshire | 3 years | 5502.00 | 235.42 | 4.28 | 300 | |
| Witch | G. Ayrshire | 3 years | 6369.00 | 300.38 | 4.72 | 300 | |
| Wren | G. Ayrshire | 4 years | 5034.00 | 266.05 | 5.28 | 300 | |
| Polly | G. Friesland | Mature | 6881.00 | 245.40 | 3.57 | 300 | C. F. S. Morkel, "Two Streams," P.B. Macheke. |
| Merle | G. Guernsey | Mature | 6201.00 | 284.68 | 4.59 | 280 | G. R. Morris, P.O. Box 1040, Salisbury. |
| No. 137 | G. Friesland | Mature | 6706.00 | 232.56 | 3.47 | 300 | F. B. Morrisby, Box 36, Gwelo. |
| No. 152 | G. Friesland | Mature | 9050.00 | 293.59 | 3.24 | 300 | |
| Manyerket | G. Friesland | Mature | 6741.10 | 227.29 | 3.37 | 300 | J. T. Mungle, "Myreside," Odzi. |
| Gramet I | G. Friesland | Mature | 7076.00 | 243.32 | 3.44 | 300 | K. Norvall, Box 637, Bulawayo. |
| Katang | G. Red Poll | Mature | 7050.00 | 242.15 | 3.43 | 249 | |
| Minhinick Petal | P.B. Friesland | 2 years | 8669.00 | 299.72 | 3.57 | 300 | |
| Nazaret II | G. Friesland | 3 years | 5876.00 | 239.29 | 4.07 | 300 | |
| Seaborough Barbara | P.B. Friesland | 3 years | 10327.00 | 328.65 | 3.18 | 279 | |
| Seaborough Colleen | P.B. Friesland | 4 years | 7444.00 | 250.60 | 3.37 | 300 | |
| Windy II | G. Friesland | 3 years | 6258.00 | 232.52 | 3.72 | 292 | |
| No. 55 | G. Red Poll | 4 years | 5796.40 | 238.03 | 4.11 | 300 | J. L. Pakenham, Thornlea Farm, Heany Junction. |
| Edna III | G. Friesland | 2 years | 6887.80 | 226.92 | 3.29 | 269 | E. Palmer, Ferndale, Penhalonga. |
| Norris | G. Guernsey | Mature | 7401.90 | 288.76 | 3.90 | 256 | |
| Shasha IV | G. Friesland | 2 years | 7543.20 | 243.10 | 3.22 | 300 | |
| Socks | G. Friesland | Mature | 6953.80 | 270.37 | 3.89 | 245 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cid's Dame | G. Jersey | Mature | 6163.50 | 360.77 | 5.85 | 300 | Mrs. E. L. Parkes, P.O. Box 159, Salisbury. |
| Dairy | G. Jersey | Mature | 7238.00 | 379.97 | 5.26 | 300 | |
| Domby | G. Jersey | 4 years | 5441.00 | 281.26 | 5.17 | 292 | |
| Samuelle | G. Jersey | Mature | 6458.00 | 324.43 | 5.02 | 300 | |
| Butter Knife | G. Friesland | 2 years | 6446.80 | 268.01 | 4.16 | 292 | J. D. Parsons, P.O. Box 7, Bulawayo. |
| Princess | G. Friesland | 4 years | 6294.70 | 234.70 | 3.73 | 239 | |
| May | G. Friesland | 3 years | 9193.00 | 336.94 | 3.67 | 265 | |
| Pam | G. Friesland | 3 years | 9892.60 | 307.44 | 3.11 | 253 | |
| Margaret | G. Friesland | Mature | 6305.50 | 234.26 | 3.55 | 300 | Rhod. Corp., Ltd., Kent Estate, Norton. |
| Reinera | G. Friesland | Mature | 5991.50 | 264.62 | 4.42 | 300 | |
| Edward | G. Friesland | Mature | 7937.60 | 245.89 | 3.09 | 254 | G. W. Robinson, P.O. Box 346, Salisbury. |
| Gwyman | G. Friesland | 3 years | 8528.20 | 312.83 | 3.67 | 300 | |
| Loppy | G. Friesland | 3 years | 6359.90 | 236.16 | 3.71 | 300 | |
| Nincompoop II | G. Friesland | 4 years | 9331.30 | 351.13 | 3.76 | 300 | |
| Quaker No. 10 | G. Friesland | 4 years | 7208.50 | 262.08 | 3.64 | 300 | |
| Taglia | G. Friesland | Mature | 6340.90 | 239.60 | 3.78 | 275 | |
| No. 14 | G. Friesland | 4 years | 6797.70 | 269.35 | 3.85 | 300 | |
| Bluebell | G. Friesland | Mature | 5810.30 | 284.66 | 4.90 | 300 | Mrs. D. M. Rutherford, P.O. Box 25, Marandellas. |
| No. 14 (Harriet) | G. Friesland | Mature | 6449.70 | 230.38 | 3.57 | 300 | |
| Gilila | G. Friesland | 3 years | 7131.90 | 280.41 | 3.93 | 300 | |
| Blantyre | G. Friesland | Mature | 8329.50 | 280.61 | 3.37 | 300 | W. F. H. Scutt, Maple Leaf, Norton. |
| Daniel | G. Friesland | 3 years | 6824.40 | 247.69 | 3.63 | 300 | |
| James | G. Friesland | Mature | 7378.80 | 278.16 | 3.77 | 300 | |
| Japan | G. Common | 2 years | 6390.70 | 236.68 | 3.70 | 300 | |
| Jim | G. Friesland | 4 years | 9013.60 | 283.84 | 3.15 | 300 | |
| Mahule | G. Common | 3 years | 6138.10 | 266.57 | 4.34 | 290 | |
| Mariko | G. Friesland | 2 years | 5889.30 | 226.64 | 3.85 | 254 | |
| Polly | G. Friesland | Mature | 7759.30 | 269.17 | 3.47 | 281 | |
| Cherry | G. Friesland | Mature | 5760.00 | 228.94 | 3.98 | 300 | L. F. Sheffield, Orange Park, P.O. Macheke. |
| Meadows Nelly 25 | G. Jersey | 2 years | 4288.40 | 239.23 | 5.50 | 249 | S. M. Sinclair, Albany, P.B. Melsetter. |
| Meadows Nelly 24 | G. Jersey | 2 years | 4163.30 | 225.44 | 5.41 | 223 | |
| Stienie | G. Friesland | Mature | 5607.00 | 229.29 | 4.09 | 300 | E. Stanger, Chimbi Source, P.O. Rusape. |
| Battle Rosemary III | P.B. Ayrshire | Mature | 6837.00 | 239.86 | 3.51 | 300 | J. R. Stewart & Sons, Ltd., Battle Farm, P.O. Shangani. |
| G. 44 | G. Ayrshire | 3 years | 6611.00 | 250.21 | 3.78 | 300 | |
| G. 41 | G. Ayrshire | 3 years | 9374.00 | 318.46 | 3.40 | 300 | |

**SEMI-OFFICIAL**—(Continued).

| *Name of Cow.* | *Breed.* | *Age.* | *Milk in lbs.* | *B. Fat in lbs.* | *Average % B. Fat.* | *No. of Days.* | *Name and Address of Owner.* |
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| Tina II | G. Friesland | 2 years | 6763.00 | 232.49 | 3.44 | 300 | Susman & Newfield, Box 959, Salisbury. |
| S/125 | G. Friesland | 2 years | 6989.00 | 250.78 | 3.59 | 300 | |
| S/131 | G. Friesland | 2 years | 6238.00 | 243.29 | 3.90 | 300 | |
| S/143 | G. Friesland | 2 years | 5427.00 | 244.21 | 4.50 | 300 | |
| S/144 | G. Friesland | 2 years | 5426.00 | 236.93 | 4.37 | 300 | |
| Bandit III | G. Friesland | 2 years | 6451.00 | 250.01 | 3.87 | 300 | E. Tapson Trust, Ltd., Lesapi Falls, Rusape. |
| Beans I | G. Friesland | Mature | 8383.00 | 293.77 | 3.50 | 300 | |
| Betty | G. Friesland | Mature | 8315.00 | 315.14 | 3.79 | 300 | |
| Buhera | G. Friesland | Mature | 6538.00 | 263.12 | 4.02 | 273 | |
| Chichaka II | G. Friesland | 2 years | 7232.00 | 235.99 | 3.26 | 300 | |
| Christina | G. Friesland | 2 years | 7339.00 | 251.32 | 3.43 | 300 | |
| Dodo | G. Friesland | 4 years | 10802.00 | 412.44 | 3.82 | 300 | |
| Gracie | G. Friesland | Mature | 6243.00 | 232.25 | 3.72 | 271 | |
| Janette II | G. Friesland | 2 years | 6426.00 | 304.12 | 4.73 | 300 | |
| Martinonga | G. Friesland | 2 years | 6176.00 | 242.88 | 3.93 | 300 | |
| Miriam IV | G. Friesland | Mature | 10185.00 | 382.28 | 3.75 | 300 | |
| Nazaret | G. Friesland | 2 years | 6862.00 | 258.88 | 3.77 | 300 | |
| Prieska | G. Friesland | 2 years | 6546.00 | 228.14 | 3.49 | 300 | |
| Rowende | G. Friesland | 3 years | 8714.00 | 313.12 | 3.59 | 300 | |
| Sabina | G. Friesland | Mature | 8303.00 | 334.70 | 3.89 | 300 | |
| Stick | G. Friesland | 2 years | 6119.00 | 253.51 | 4.14 | 300 | |
| Japan II | G. Friesland | 2 years | 7253.00 | 261.59 | 3.61 | 300 | |
| Joeburg | G. Friesland | Mature | 7700.90 | 289.50 | 3.76 | 281 | L. Taylor, Box 55, Selukwe. |
| Kafela | G. Friesland | Mature | 6719.50 | 238.40 | 3.55 | 300 | |
| Macombe I | G. Friesland | Mature | 8165.80 | 273.70 | 3.35 | 300 | |
| Baxter | G. Friesland | Mature | 6764.80 | 239.50 | 3.54 | 282 | A. W. Tennent, Kelvin, Headlands. |
| Daisy | G. Friesland | Mature | 6411.40 | 260.91 | 4.07 | 256 | |
| Eva | G. Friesland | Mature | 9093.90 | 314.52 | 3.46 | 300 | |
| Maude | G. Friesland | Mature | 8038.40 | 287.22 | 3.57 | 300 | |
| Nellie | G. Friesland | Mature | 6814.20 | 237.50 | 3.49 | 300 | |
| No. 11 | G. Friesland | Mature | 7609.90 | 277.54 | 3.65 | 300 | |
| No. 24 | G. Friesland | Mature | 5689.80 | 254.66 | 4.48 | 248 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
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| Marandellas | G. Red Poll | Mature | 6503.00 | 237.05 | 3.65 | 300 | |
| Maricop II | G. Red Poll | Mature | 6494.80 | 240.76 | 3.71 | 300 | |
| Nyagool | G. Red Poll | Mature | 5275.80 | 232.07 | 4.40 | 231 | |
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| Ebony | G. Friesland | Mature | 6866.00 | 252.61 | 3.68 | 300 | R. O. Waldschutz, Mere, Marandellas. |
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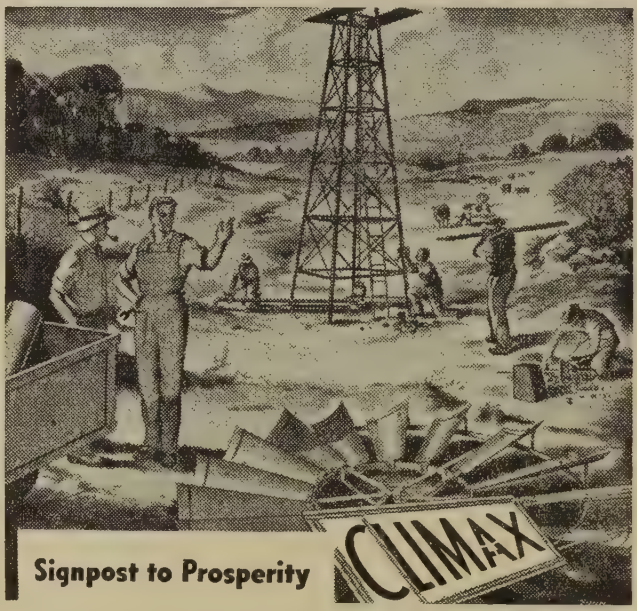


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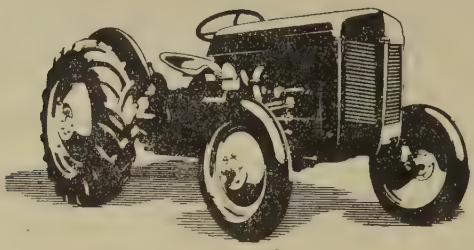

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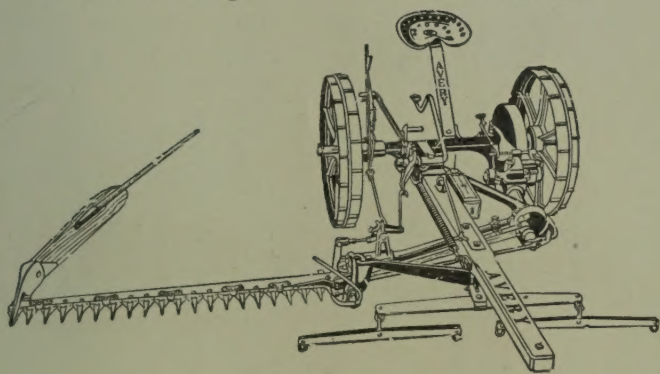


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